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Railway Mechanical Engineer

July
1945

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Makes QUICKER work of removing road grime from locomotive running gear!

BY SPEEDING-UP the cleaning of locomotive running gear between runs, or before repair or overhaul, Oakite steam-detergent and pressure-solvent degreasing methods are helping Mechanical Supervisors put equipment back into service ON TIME! In fact, many Class I and Class II roads . . . faced with the problem of handling more of this maintenance work on shorter schedules and with increasingly limited manpower . . . report that these dependable techniques are important factors in reducing out-of-service time.

FAST . . . EFFECTIVE . . . ECONOMICAL!

Try either one of these convenient, easily applied methods . . . and see for yourself what it can do! Whichever one you use, you will find it effectively removes oil, grease and road grime from running gear in much less time and with considerably less manual effort than generally possible with other procedures. And because Oakite cleaning is so economical, it puts this work on a NEW low-cost basis! Further data available FREE on request. Write TODAY . . . no obligation whatever, of course.

OAKITE PRODUCTS, INC., WRIGLEY BUILDING, CHICAGO 11, ILL.

In Canada: OAKITE PRODUCTS OF CANADA, LTD.

TORONTO: 65 Front St. East—MONTREAL: 1 Van Horne Ave.

"KEEP POWER ROLLING"

Pledged to Help Railroads Meet War Traffic Demands!

Because they speed-up maintenance of Diesel locomotives, steam power and rolling stock . . . provide FASTER cleaning that helps put equipment quickly back into service, that meets the requirements of safety and low cost . . . Oakite materials and methods are being standardized by many leading roads for such other jobs as (1) steam cleaning locomotive frames before fracture test; (2) cleaning housings, drive rods, brake linings, journal boxes, etc. before inspection and repair; (3) cleaning and deodorizing freight and refrigerator cars; and (4) cleaning air compressors.

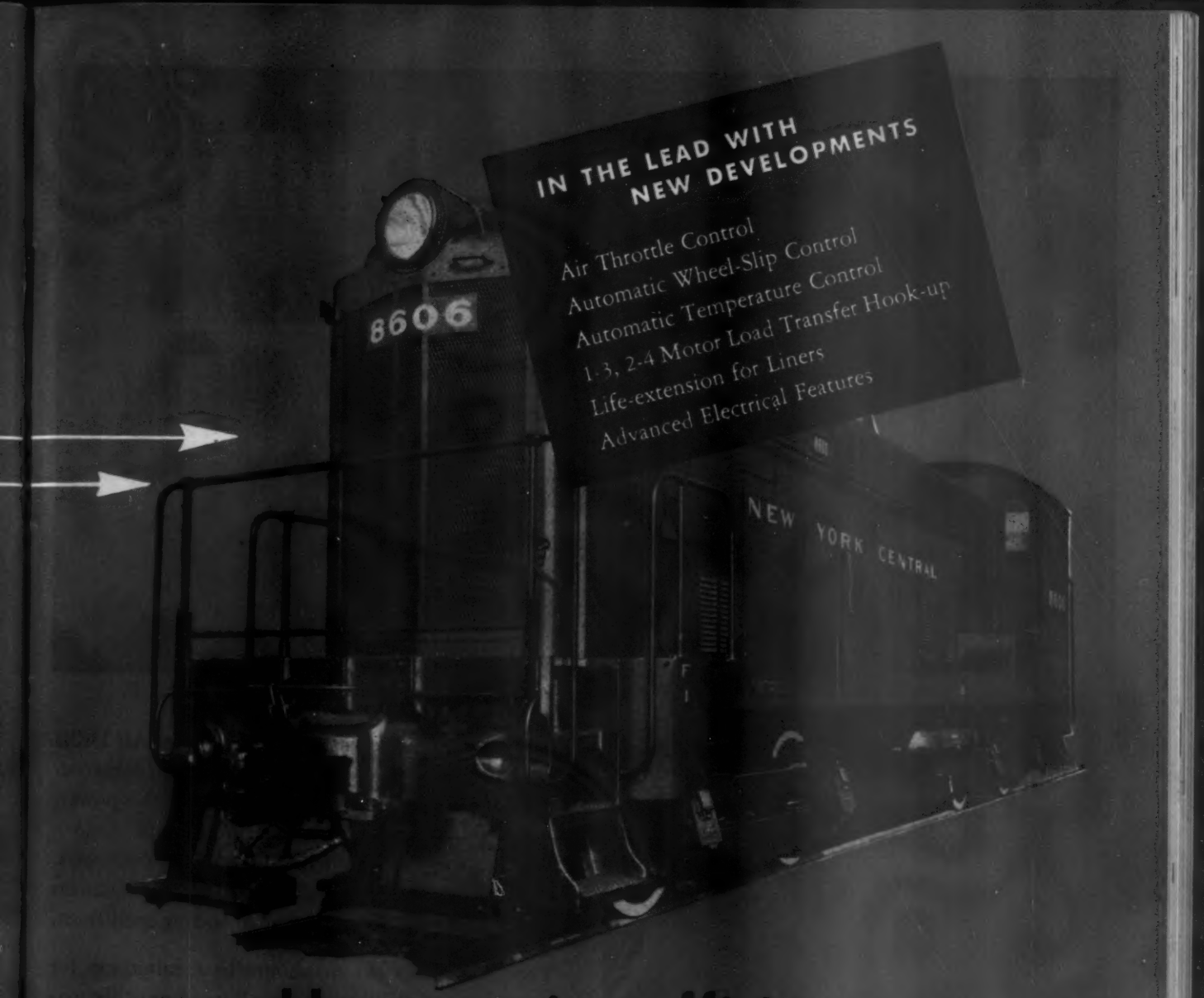
OAKITE

RAILWAY SERVICE DIVISION

This Automatic Temperature Control

The engine never takes a chill or runs a fever on Baldwin-Westinghouse Diesel Electric Locomotives, whether the units are operating in desert heat or arctic cold, hauling a 50-car train or running light. A small, compact, sturdy automatic device keeps an eye and a finger on the engine temperature, maintains it steadily at the point that will produce highest efficiency.

This is only one of an array of important



adds to engine efficiency on Baldwin-Westinghouse Diesel Electrics

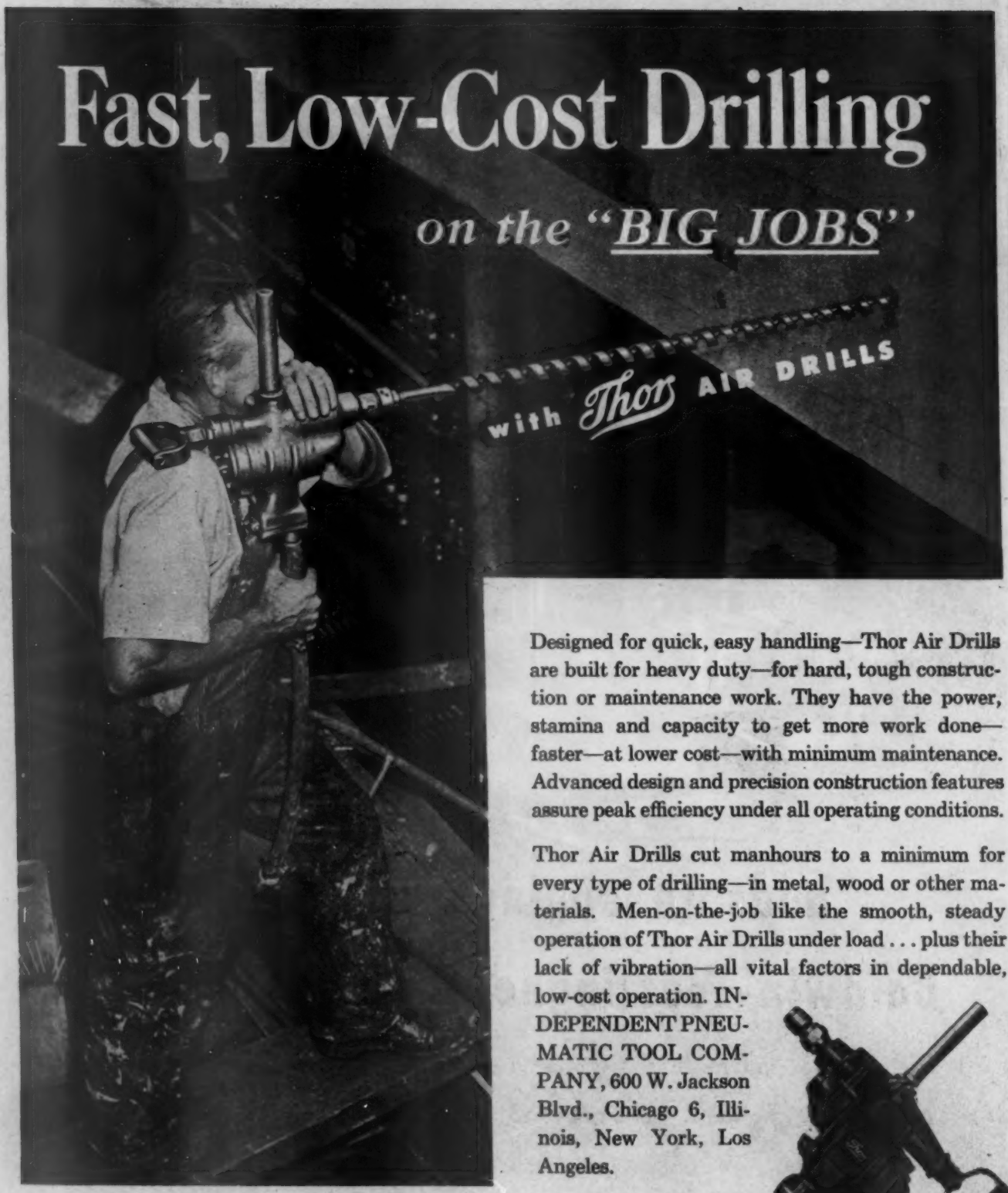
and exclusive features that recommend Baldwin-Westinghouse locomotives to roads that are seeking ease of operation, high availability, top economy and efficiency, and freedom from excessive maintenance. When you buy your next diesel-electric locomotives, check up on all the advantages that Baldwin-Westinghouse units have to offer.

THE BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA

Westinghouse ELECTRIC CORPORATION, EAST PITTSBURGH, PA.

Fast, Low-Cost Drilling

on the "BIG JOBS"



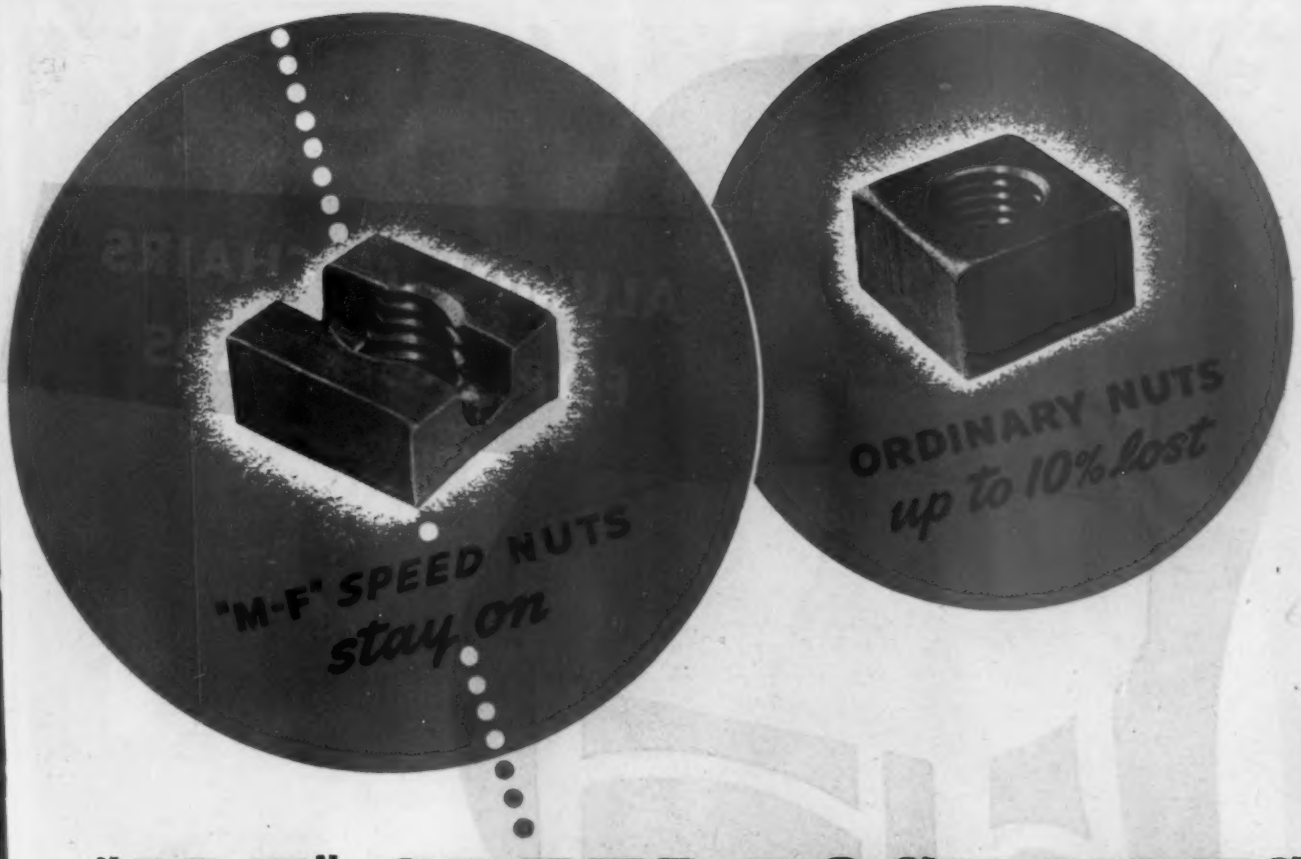
Designed for quick, easy handling—Thor Air Drills are built for heavy duty—for hard, tough construction or maintenance work. They have the power, stamina and capacity to get more work done—faster—at lower cost—with minimum maintenance. Advanced design and precision construction features assure peak efficiency under all operating conditions.

Thor Air Drills cut manhours to a minimum for every type of drilling—in metal, wood or other materials. Men-on-the-job like the smooth, steady operation of Thor Air Drills under load . . . plus their lack of vibration—all vital factors in dependable, low-cost operation. INDEPENDENT PNEUMATIC TOOL COMPANY, 600 W. Jackson Blvd., Chicago 6, Illinois, New York, Los Angeles.

Above: A No. 362-RWX Rotary Drill boring 1½" holes in deck girder and beam on wooden minesweeper.

Thor PORTABLE POWER TOOLS

PNEUMATIC
UNIVERSAL ELECTRIC
HIGH FREQUENCY ELECTRIC



"M-F" *SPEED* LOCK NUTS
... *cost less to use*

A recent investigation of freight cars disclosed the fact that as many as 10 per cent of common nuts were missing from floor bolts . . . and that *no cars with missing "M-F" Speed Lock Nuts were found.*

If only 2½ per cent of the common nuts were missing, the AAR charges for replacement would be greater than the difference in cost between "M-F" Speed Lock Nuts and common nuts.

"M-F" Speed Lock Nuts . . . on to *stay* . . . cost *less* to use . . . *less expensive* in the long run.

"M-F" Speed Lock Nuts also eliminate other losses caused by common nuts, such as wear and tear on the car, and revenue time required for repairs.

MAC LEAN-FOGG LOCK NUT COMPANY

2649 N. Kildare Avenue, Chicago 39, Illinois • ***In Canada: The Holden Co., Ltd., Montreal***

ALUMINUM CHAIRS FOR RAILROADS

Designed by Pullman-Standard Car Mfg. Co., this chair was especially built for them by General Fireproofing Co.

New comfort and beauty are featured in the chairs of Alcoa Aluminum made by General Fireproofing Company especially for use in railroad cars.

They are not only attractive, but they are lightweight, too. They will be easy for passengers to move—convenient for crews to stack. And most important to the railroads, they are durable.

These modern, lightweight chairs attracted unusual attention and many favorable comments when they were shown in the Pullman-Standard exhibit "Tomorrow's Trains Today".

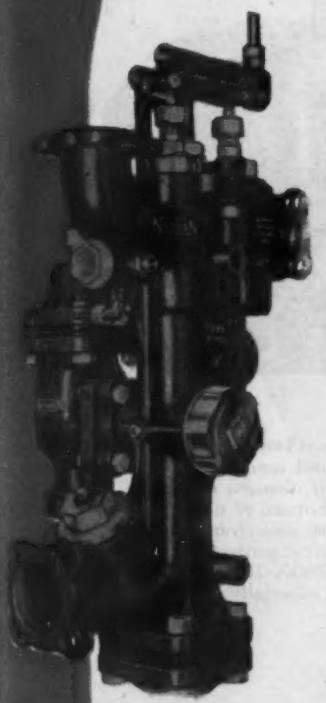
ALUMINUM COMPANY OF AMERICA, 1929 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM

ALCOA ALUMINUM

NATHAN PRODUCTS

ON THE NEW YORK CENTRAL'S *New* NIAGARA

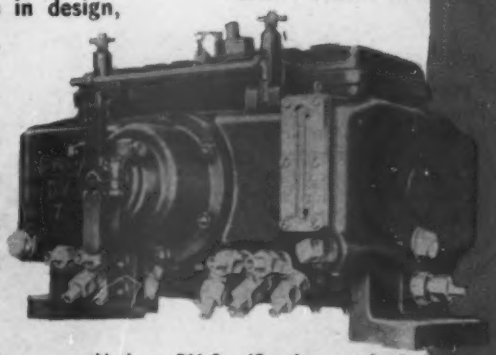


Nathan Type 4000 Injector meets every requirement for heavy duty locomotive service. It is safe, reliable and simple to operate.

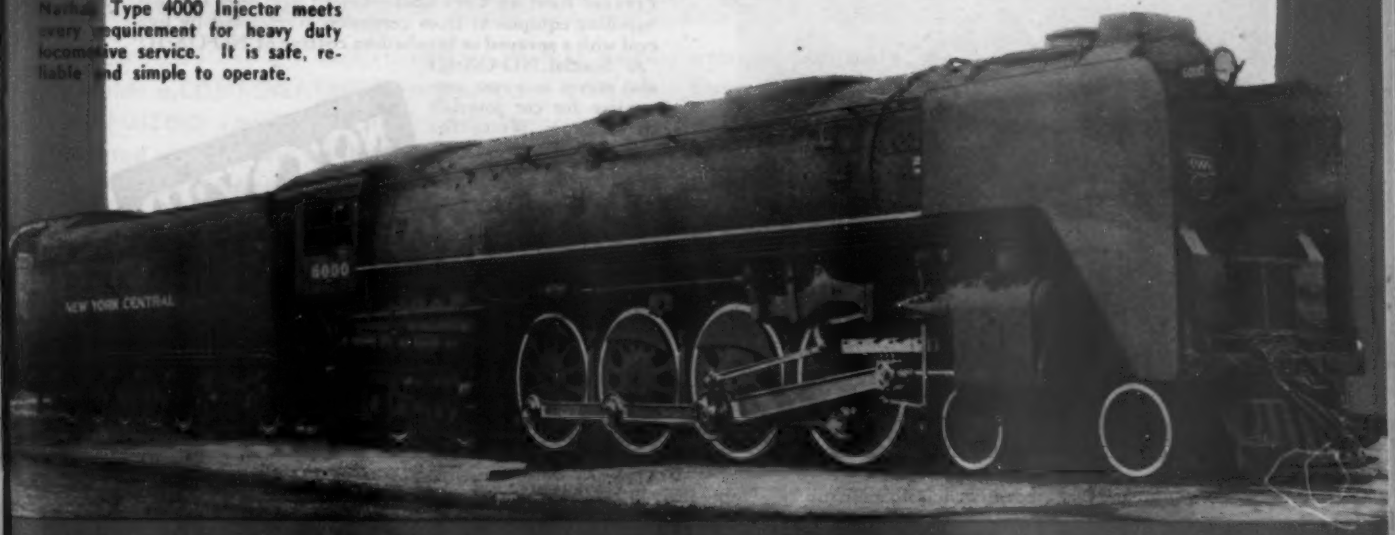
THE Niagara is the newest and most powerful steam locomotive designed and constructed for the New York Central to operate in high-speed passenger and freight service.

In keeping with the many notable advances in design, power and efficiency, it is very significant that the Niagara is equipped with several Nathan products. There's the Nathan DV-8, 42 pint mechanical lubricator, the Nathan Type 4,000, 14,000 gallon capacity injector, the boiler checks and the Nathan force feed lubricator on the boiler hot pump.

Nathan products, serving railroads over 80 years, have contributed much to the progress in locomotive design and performance.



Nathan DV-8, 42 pint mechanical lubricator provides valveless feeds to piston valves, cylinders, guides and stoker engine.



NATHAN MANUFACTURING CO., 250 PARK AVE. NEW YORK 17, N. Y.

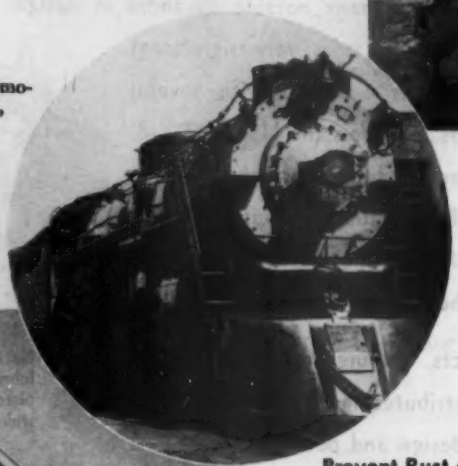
Established 1864

RUST IT CAN'T HAPPEN HERE!

if they're rust-proofed with NO-OX-ID

. The old original rust preventive, NO-OX-ID, prevents rust permanently on all types of railway cars.

Special consistencies have been formulated for use on new cars and for cars going through the shop for scheduled repairs. NO-OX-ID Filler Red "C" is the consistency recommended for riveted metal-to-metal contact areas. When the NO-OX-ID protective film is applied to clean metal surfaces, it immediately establishes firm contact, sealing out moisture and oxygen. No oxidizing or shrinking of the film in contact areas takes place to permit moisture or other corrosion exciters to enter these areas in future years.



Protect Locomotives—(*right*) Locomotive cab interiors behind sheathing, outside boiler surfaces, interior locomotive, main reservoirs, and all bright parts can be protected with NO-OX-ID. There's less time out for repairs on NO-OX-ID protected locomotives. *Photo Courtesy Burlington Route.*

Safeguard Tenders—(*above*) Tender reservoirs and tender coal space, including stoker pit, troughs and parts, as well as outside bottom of old style tender tanks and tender underframes, will have a longer service life if protected with NO-OX-ID. Use NO-OX-ID to stop rust on pipe threads, especially of air hose couplers.

Prevent Rust on Coal Cars—Guard steel open top coal handling equipment from corrosion accelerated by live coal with a sprayed or brushed-on coating of NO-OX-ID "A" Special. NO-OX-ID also serves as a rust preventive for car journals in storage. Write for complete details.

NO-OX-ID IRON RUST
REG. TRADEMARK AUG. 27, 1918

The ORIGINAL RUST PREVENTIVE

Dearborn Chemical Company • Dept. RM, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

NOTHING LOCKS LIKE A SPEED NUT

SPEED NUTS are the only fastening devices that provide a COMPENSATING thread lock and a SELF-ENERGIZING spring lock. TWO distinct forces are exerted on the screw, as the SPEED NUT is tightened.

First, a compensating thread lock, the two arched prongs moving inward to engage and lock against the root of the screw thread. These free-acting prongs compensate for tolerance variations, and function perfectly on oversize or undersize screw or bolt threads.

Second, a self-energizing spring lock, created by the compression of the arch in both the prongs and base. The combined forces of the thread lock and spring lock definitely eliminate vibration loosening.

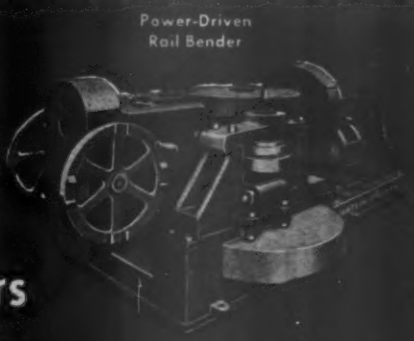
SPEED NUTS, proven in pre-war commercial industry and now boosting the production of airplanes, are ready to assist you in the assembly of post-war metal, vitreous enamel, plastic or wood products. Literature is available on over 3000 shapes and sizes, for standard or special assemblies.

TINNERMAN PRODUCTS INC.
2029 Fulton Road **Cleveland 13, Ohio**

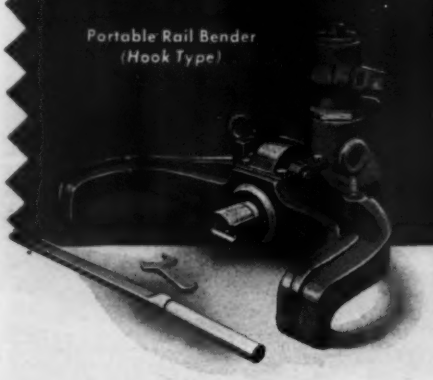
Speed Nuts®
PATENTED
® Trade Mark Reg. U. S. Pat. Off.

FOR FAST FORCING AND BENDING JOBS

—on Rails, Wheels, Cylinders and Valve Bushings


Power-Driven Rail Bender


Crank Pin and Forcing Press


Portable Rail Bender (Hook Type)


Pulling Jack

The W-S Railroad Shop Equipment shown is but part of a complete line of W-S Bushing and Wheel Presses, Pit Jacks and Spring Shop Machines that have served railroad repair shops and builders of railroad equipment for over 60 years.

For forcing crank pins in and out of locomotive wheels, and for forcing gears, pulleys, wheels, sleeves and couplings on and off axles and shafting. Pressure is applied by air or motor-driven pump with hydraulic pullback, or by hand pump with rack and pinion pullback.

W-S Pulling Jacks are used by railroad engine builders and repair shops for inserting and removing bushings in locomotive cylinders and valves. Work is done without removing cylinders, resulting in a saving in time.

W-S Portable Rail Benders, of the hook or hinged-yoke type, efficiently bend flat, "T", girder, and guard rails. The yoke type is of rugged construction and equipped with formed bending blocks. Power-driven Rail Benders of 100-ton capacity are available for bending rail sections to any desired radius, or to straighten curved rails.

Bulletin No. 560-A is one of a new series of bulletins describing W-S railroad shop equipment. It gives complete details and specifications of the tools illustrated above. For *your* copy of this bulletin and other W-S railroad shop equipment bulletins . . . write The Watson-Stillman Co., Roselle, N. J.

7345

WATSON-STILLMAN
HYDRAULIC MACHINERY DIVISION

FACTORY AND MAIN OFFICE
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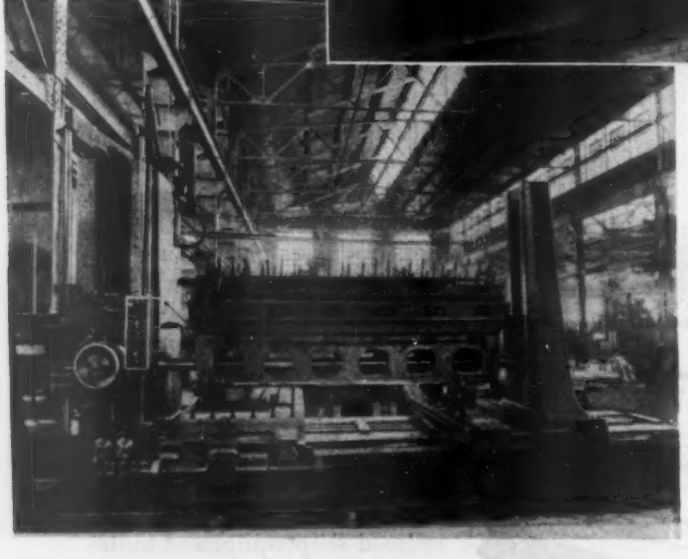
LUCAS "Precision" HORIZONTAL BORING MACHINE



Simplifies DIESEL REPAIRS

LUCAS versatility is again demonstrated in this mid-western shop, where a 4½" Spindle LUCAS Horizontal Boring Machine has simplified Diesel engine repairs . . . The main illustration shows a 12 cylinder V-type Diesel engine crankcase upended and mounted on the LUCAS for reboring welded cylinder head wells and lower cylinder liner seats. The smaller illustration shows the same crankcase mounted on the same LUCAS machine for the reboring of the main crankshaft bearings. Always recognized as a PRECISION machine, and a machine on which big jobs are easily mounted, this LUCAS Horizontal Boring Machine is making Diesel engine repairs speedily, accurately and easily. Its great versatility eliminates the necessity of transferring the work from one machine to another.

LUCAS MACHINE TOOL CO.
CLEVELAND, OHIO

NEW YORK, SUSQUEHANNA & WESTERN

FIRST ALL DIESEL-ELECTRIC CLASS I ROAD

Delivery of 16th Alco-G.E. diesel-electric completes dieselization program started in 1941. 32 steamers released.

"Our conversion to all diesel-electric operation is producing savings of more than $400,000 a year—a 29 per-cent return on the investment. In addition, diesel-electrics will reinforce our postwar financial position. Four years of wartime experience with Alco-G.E. units has convinced us that 16 of them are capable of handling considerably more freight and passenger traffic, on faster schedules, than was possible with the 32 steam locomotives they replaced."

Trustee, New York, Susquehanna & Western Railroad

Alco GE

AMERICAN LOCOMOTIVE and GENERAL ELECTRIC

How an Alco-G.E. survey started the S

ESTIMATED ANNUAL SAVINGS AFTER CONVERSION TO ALL DIESEL-ELECTRIC OPERATION

OPERATING COSTS*	Increase	Decrease
173,708 passenger locomotive-miles at $.5100 less cost per mile		$88,600
548,461 freight locomotive-miles at $.5997 less cost per mile		328,900
Total		417,500
Rent of steam engines		14,600
TAXES	$12,500	
Net increase		
DEPRECIATION	39,800	
Net increase		
ADDITIONAL ENGINEHOUSE EXPENSE		
2496 dispatchments at Jersey City at $4.25 less cost each		10,600
ELIMINATION OF 75 COAL CARS		
Depreciation at 2.83 per cent		5,300
Maintenance at $100 per year		7,500
MAINTENANCE OF WAYS AND STRUCTURES		
Elimination of steam-locomotive facilities		10,900
Improvements for diesel-electrics	3,100	
	$55,400	$466,400
SAVINGS**		$411,000
INVESTMENT— ALCO-G.E. DIESEL-ELECTRICS		$1,402,700
RETURN ON INVESTMENT		29.3%

*Based on actual results obtained with 8 Alco-G.E. diesel-electrics during 1941–1944 and calculated for a postwar traffic load equal to 1940.

**Also based on 1941–1944 costs. At 1940 costs the savings would be correspondingly less.

Total saving each year now amounting to more than one-quarter the cost of the diesel-electrics

In two easy steps, the New York, Susquehanna & Western has progressed from an all steam-locomotive road with operating costs of $1.14 per freight locomotive-mile to an all diesel-electric road with operating costs of 60 cents per freight locomotive-mile.

It started in 1941, when Alco-G.E., at the request of the Susquehanna, completed a motive-power survey of the road and showed that the installation of eight 1000-hp Alco-G.E. units would produce operating economies estimated at $130,000 a year—a 19.8 per-cent return on the cost of the eight locomotives.

In service, the diesel-electrics exceeded expectations. In 1943, it was possible to effect a 25 per-cent reduction in motive power and, at the same time, absorb the Susquehanna's 23 per-cent increase in traffic over that of 1942.

As a result of this highly satisfactory performance, the Susquehanna requested Alco-G.E. to make another survey in 1944, this time with the objective of releasing the balance of the Susquehanna's steamers, passenger as well as freight. Eight more 1000-hp Alco-G.E. units of the road-switcher type were purchased. The last one has just been delivered, making the Susquehanna the first all diesel-electric Class I road. The few steam locomotives temporarily retained will be retired as soon as present traffic peaks ease off.

On the basis of actual costs in 1943, the 16 diesel-electrics are slashing operating costs at the rate of $417,000 a year. In addition, the purchase of 75 coal cars to service steam locomotives has been made unnecessary. The savings in maintenance of way and structures, after allowance for new diesel-electric facilities, amount to more than $7000 a year.

An important factor in the initiation of this diesel-electric program was the motive-power study made by Alco-G.E. in 1941. It is one reason why the Susquehanna, with all diesel-electrics, is thoroughly prepared to handle postwar traffic most efficiently and economically.

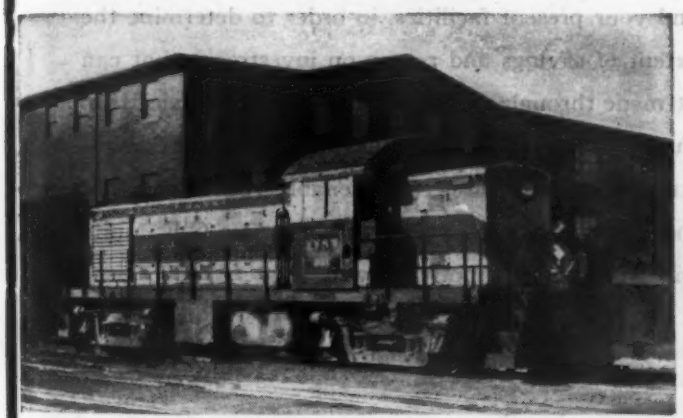
Alco GE

AMERICAN LOCOMOTIVE

Susquehanna toward $411,000 annual savings

20,000,000 PASSENGER-MILES a year are handled by the diesel-electrics at an operating cost of 49 cents per locomotive-mile as against $1.00 per locomotive-mile for steamers.

6575 HOURS OF YARD SERVICE a year are being performed by the diesel-electrics at savings of more than $20,000 a year compared with the operating cost of steamers.



113,000,000 FREIGHT TON-MILES (estimated for 1945) will be handled by the diesel-electrics at an operating cost of 6[illegible] cents per locomotive-mile, compared with $1.14 per locomotive-mile for steamers.

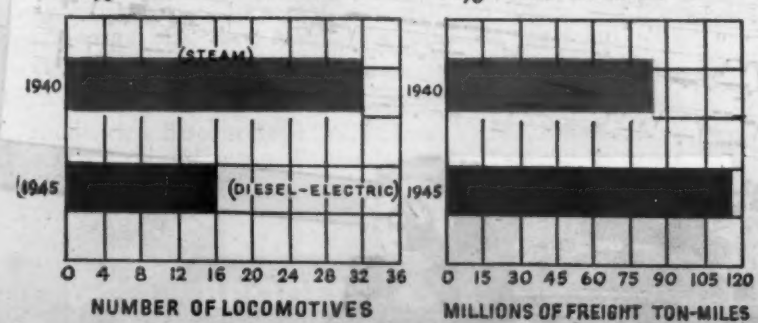
—"a commendable record" says ICC

"... We believe that some additional recognition should be given in the capital structure to the earning possibilities of this railroad. The debtor's trustee has made a commendable record in reducing the past and probable future operating expenses and in the development of traffic possibilities. Although the savings in operating expenses are not of themselves assurances of future traffic, we think that in the light of all the circumstances, including the possible savings through increases in the use of diesel-electric power, the conclusion of division 4 that the reorganized company's expectable earnings available for interest and other corporate purposes in a normal year are from $600,000 to $700,000, is somewhat too low. Upon further consideration we find that such earnings may be expected to range from $700,000 to $775,000. Under all the circumstances, we conclude that the amount of income bonds issuable at reorganization should be increased to $4,000,000 and that the amount of other securities should remain as approved in the prior report. Stating the 35,000 shares of common stock at $100 a share, the resulting capitalization will be $15,952,844. We will modify the plan accordingly."

—Excerpt from ICC Plan of Reorganization for NYS&W RR.

RESULTS OF SUSQUEHANNA'S CONVERSION TO ALL DIESEL-ELECTRIC OPERATION

50% FEWER LOCOMOTIVES DO——39% MORE WORK AT——58% LOWER COST



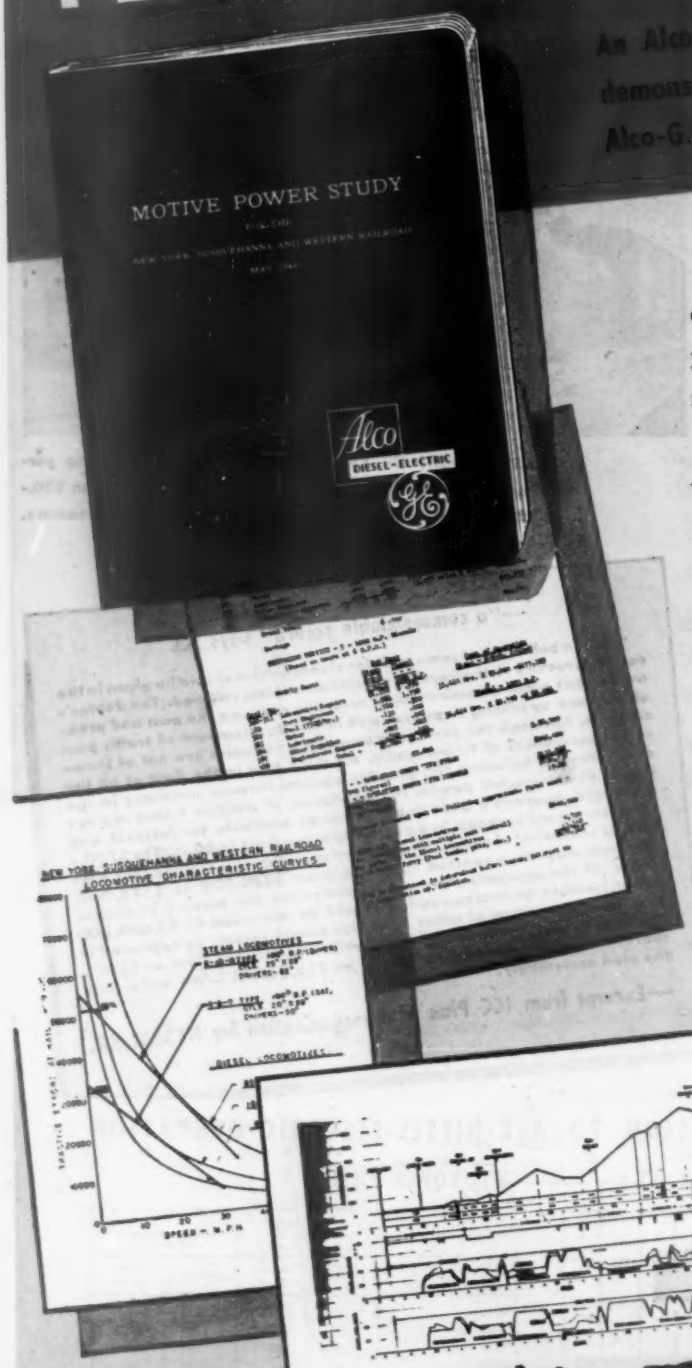
Cost Per Mile (Actual, 1943)	Passenger Service		Freight Service	
	Steam	Diesel-electric	Steam	Diesel-electric
Repairs	$.3085	$.1335	$.3365	$.1355
Enginemen	.2349	.2441	.2805	.2856
Fuel	.3330	.0775	.3906	.0775
Water	.0291		.0291	
Lubricants	.0100	.0180	.0100	.0180
Other supplies	.0100	.0100	.0100	.0100
Enginehouse expense	.0812	.0116	.0812	.0116
	$1.0067	$.4967	$1.1379	$.5382
SAVINGS		$.5100		$.5997

----PRODUCING ANNUAL SAVINGS OF $411,000

and GENERAL ELECTRIC

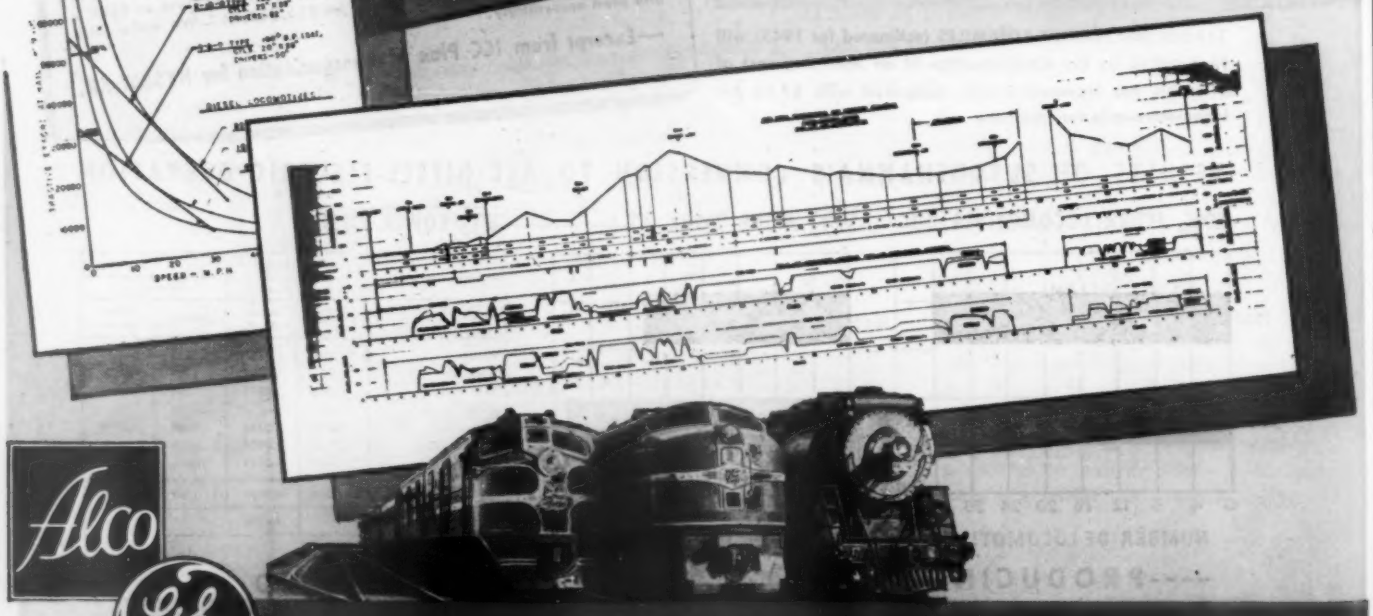
PLANNING FOR INCREASED EARNING POWER?

An Alco-G.E. motive-power study and performance demonstration will give you facts on the economies Alco-G.E. diesel-electrics will produce on your road.



Whether you are planning for a single unit or complete conversion to diesel-electric operation—you can obtain the services of our motive-power engineers for a comprehensive survey of your operations.

These engineers, working with your own organization, are prepared to study each locomotive assignment, the profile and characteristics of your terrain, and your present facilities, in order to determine the extent of savings and return on investment that can be made through the use of Alco-G.E. diesel-electrics. Furthermore, we'll gladly make a performance demonstration on your property to enable you to compare the performance characteristics of Alco-G.E. units with your present motive power.



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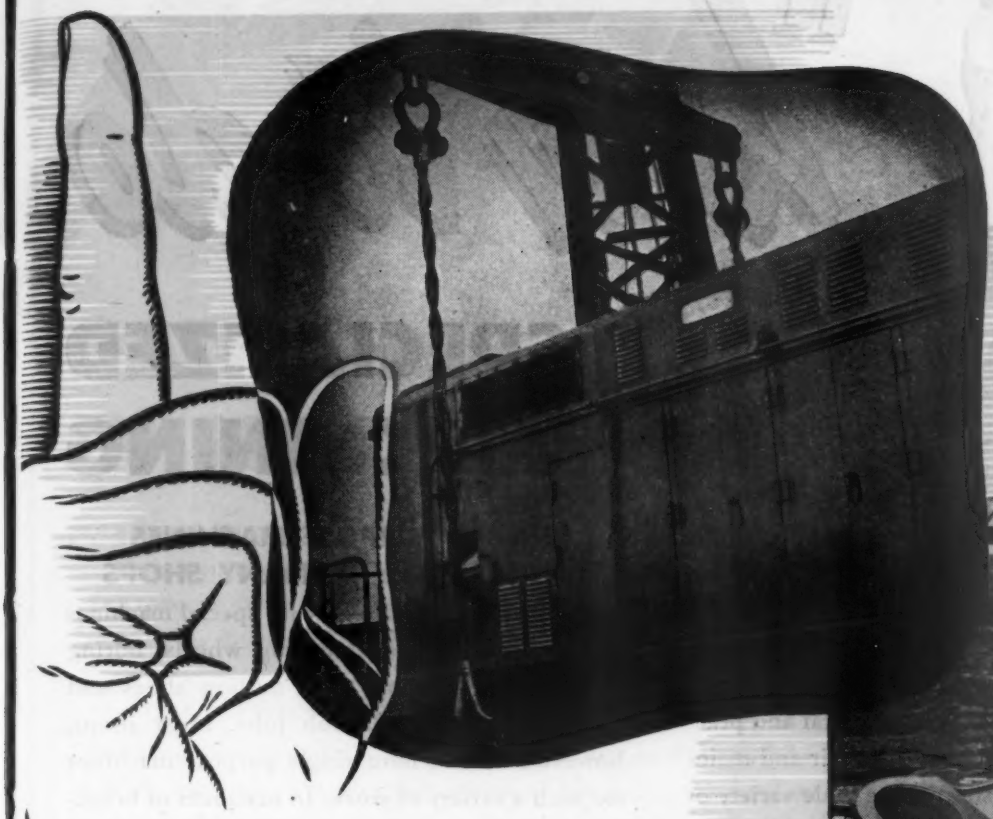
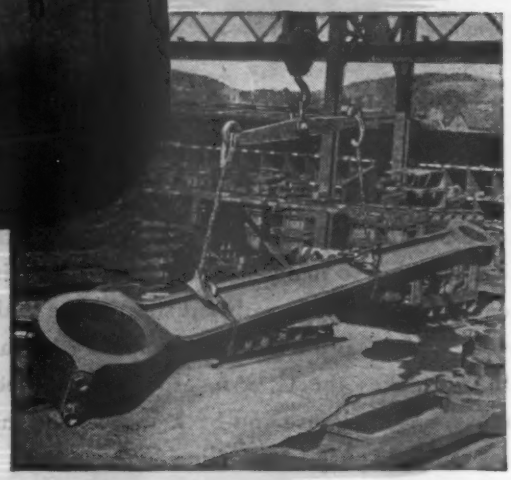




HOIST IT SAFELY!

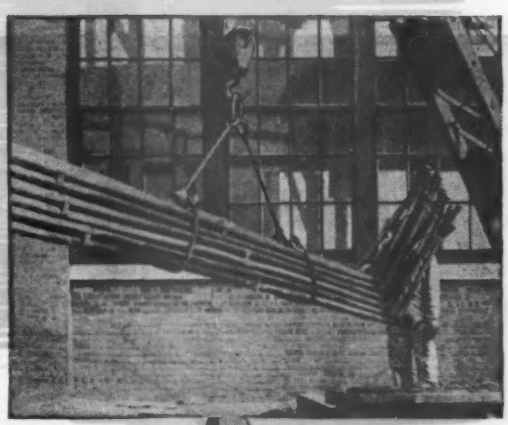
Heavy or light . . . the load is handled smoothly with flexible YELLOW STRAND *BRAIDED* SLINGS*

When you're hurrying equipment back into service, you want *help* from a sling, not hindrance. What you need in repair shop, yard, stores department or out on the wrecker is the convenience of Yellow Strand *Braided* Safety Slings. Their flexibility, kink-resistance and ease of handling enable men to make smooth, fast pickups with confidence. The lifts illustrated—Diesel locomotive, driving rod, superheater units and trailer wheels—are typical of hundreds performed daily by leading railroads.

Patented *braiding* puts added limberness into strong, durable Yellow Strand Wire Rope. The sling conforms to irregular shapes, grips curved objects firmly, takes fittings readily. Popular special designs include drawbar, mounted wheel and drum slings. Weighing less than chain, *braided* slings are easily carried and applied, using minimum manpower. Crews welcome their security on big tonnage lifts, their Manila-like pliability for small jobs.

Yellow Strand *Braided* Slings are practicable for loads ranging from salvage parts to your costliest locomotive. Investigate today.

Broderick & Bascom Rope Co., St. Louis 15, Mo. *Branches:* New York, Chicago, Houston, Portland, Seattle. *Factories:* St. Louis, Seattle, Peoria.



RIGGERS' HAND BOOK FREE: Shows sling types, fittings, capacities. Write for your copy.

*PATENTS: U. S., 1478068, 1524671, 2142641, 2142642, 2299000; CANADIAN, 251874, 254044

ARMY E NAVY

BRODERICK & BASCOM

Yellow Strand

BRAIDED SAFETY SLINGS

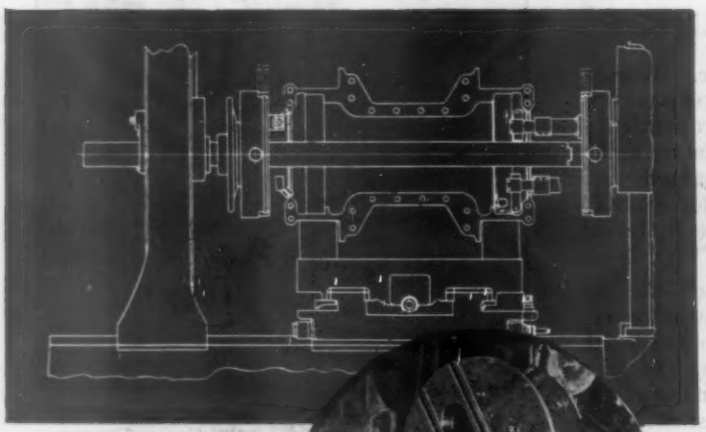
"how to do

SPECIALIZED MACHINING

Instead of having a number of expensive individual machines for single machining operations, the Giddings & Lewis Horizontal Boring, Drilling and Milling Machine offers an economical and practical solution to many special building, repair and maintenance problems in railroad shops. The wide variety of work which can be handled, coupled with machine flexibility, makes the G. & L. especially needed in round house, engine house and back shops. The initial cost of this multiple purpose machine favors its use.

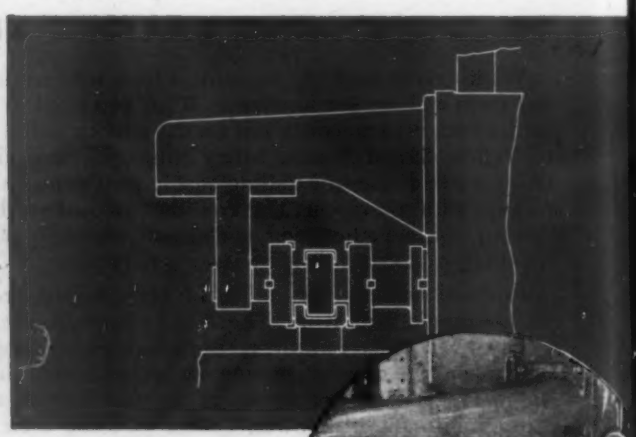
SINGLE PURPOSE MACHINES UNNECESSARY IN MANY SHOPS

A few shops are equipped with special machines for quartering drivers, turning wheels, boring cylinders, channeling rods, milling shoes and wedges and other difficult jobs. Most shops, however, do not have single purpose machines for such a variety of work. In instances of breakdown on the road, it is often necessary to make repairs in shops hundreds of miles from the point of actual breakdown. As a result, locomotives may be tied up for many days, whereas such re-

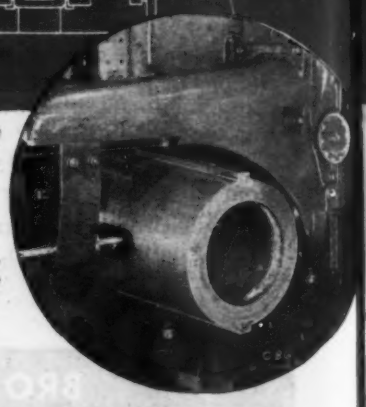


(Above) Boring and Facing Axle Housing.

(Right) Continuous Feed Facing Head with telescopic tool holder.



(Above) Milling Shoes and Wedges. Note arbor support.

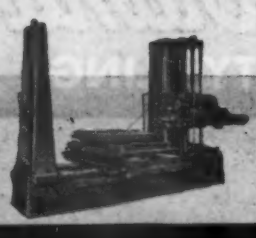


(Right) Typical arbor support used in machining large shaft.

GIDDINGS & LEWIS

150 DOTY STREET

Right: G. & L. Table Type Machine.



Right: G. & L. Floor Type Machine.

MORE RAILROAD IN LESS TIME . . ."

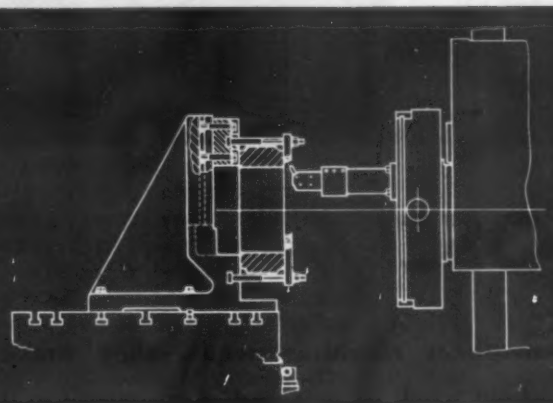
pairs could be easily handled in any shop on standard G. & L. machines equipped with standard attachments. Using such equipment reduces down time to a minimum and places the locomotive back on the road days ahead of schedule.

More Work in Less Time

Present conditions in railroad shops make it essential to produce more in less time. The simplest means of increasing production is to use the versatile G. & L. Horizontal Machine and time-saving accessories. If you have not already consulted our engineers regarding the use of Giddings & Lewis machines, it will be advantageous to submit your railroad machining problems now.

Standard G. & L. Horizontal Boring, Drilling and Milling Machine Does Difficult Round House, Engine House and Back Shop Jobs usually handled on single purpose machines

G. & L. Horizontal Boring, Drilling and Milling Machine with extended saddle, supports and rotary table.



Boring Locomotive rod ends.

Free Additional Data

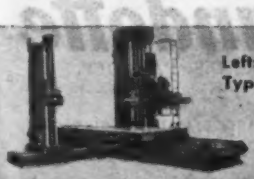
—descriptive of railroad machining operations is presented in "Railroad Shops." Write for your *free* copy today and we will include information on the complete line of Giddings & Lewis machines and time-saving accessories. Ask for Bulletin No. RM-75

MACHINE TOOL CO.

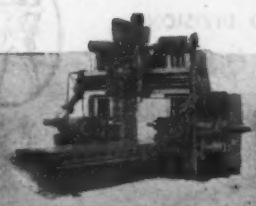
FOND DU LAC, WIS.

G. & L. DIRECT SALES AND SERVICE REPRESENTATIVES

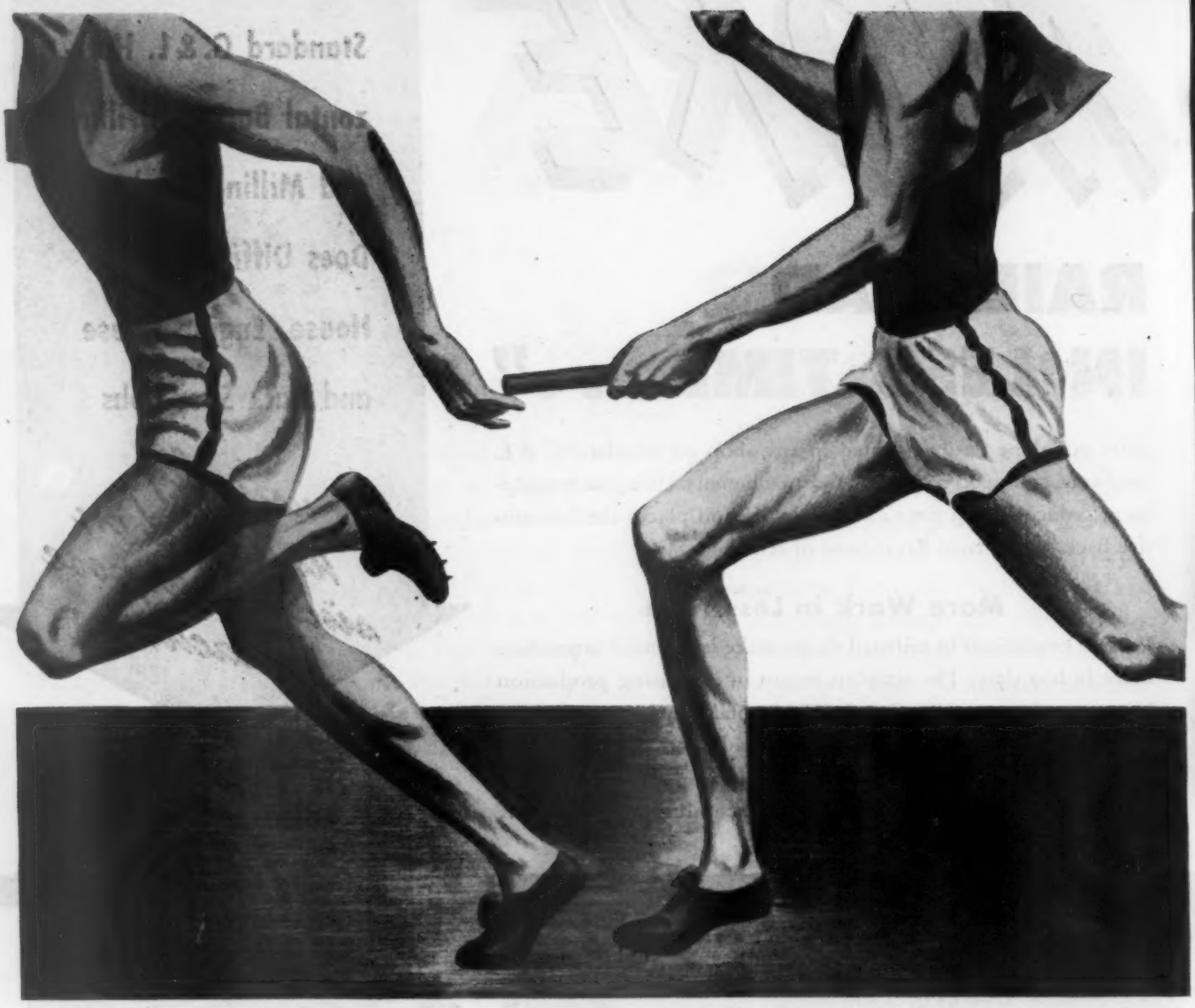
Other interesting and time-saving railroad machining practices will be described in later issues of this publication.



Left: G. & L. Planer Type Machine



Left: G. & L. Multiple Head Type Machine



NO TIME TO LOSE

Railroadmen know how relay runners feel. For no time can be wasted in maintenance and backshop work these busy days. Locomotives and equipment must be put in shape to go out on the road again *at once.*

That's why Wyandotte Railway Cleaners are in such high favor. Specialized to meet cleaning needs, they make short work of grit and soot, grease and carbon, oil and dirt deposits.

Your Wyandotte Representative has a full line of maintenance and backshop cleaners. Let him show you how they can help you.

WYANDOTTE CHEMICALS CORPORATION • J. B. FORD DIVISION
WYANDOTTE, MICHIGAN, SERVICE REPRESENTATIVES IN 88 CITIES

Wyandotte
REG. U.S. PAT. OFF.

Making Stainless Steel Electrodes is a McKAY Specialty . . . Using them is yours!

Here is a Helpful Booklet About *Welding Stainless Steel*

McKay Stainless Steel Welding Electrodes are "tops" in quality. There are good reasons for this leadership.

Among these are the standard McKay practices of: (a) Continued research in the Mellon Institute at Pittsburgh, Pa., as well as in our own laboratory at York, Pa.; (b) Analyses and correct selection, before coating, of *all* core wires; (c) use of *either* Titania or Lime Coating as preferred by you . . . not just one coating for all grades; (d) Every "batch" pilot tested before production; (e) production runs crack tested, pad analyzed, weld metal analyzed, physically tested . . . or all of these if necessary . . . to *prove* quality; (f) Exact analysis stamped on each package and certified upon request. These precautions, plus most modern production facilities, assure you of complete uniformity and successful performance.

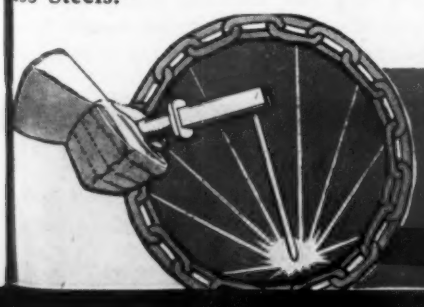
You can weld better with these better electrodes! To test your knowledge of practical stainless steel metallurgy, ask for your free copy of the new booklet, "Things to Know About Welding Stainless Steels."

TRY YOUR HAND AT THESE QUESTIONS ABOUT STAINLESS STEEL

		TRUE	FALSE
14.	A stainless steel electrode operated on reverse polarity sends its metal droplets across the arc against the stream of the electrical current.	☐	☐
15.	When welding stainless steels a short arc is preferable to a long arc.	☐	☐
16.	In order to be certain of the alloy content of welds the user of stainless electrodes should specify the analysis of the electrode core wire.	☐	☐

ANSWERS: 14. True. 15. True. 16. False.

Questions 1 to 13, inclusive, have appeared in preceding advertisements.

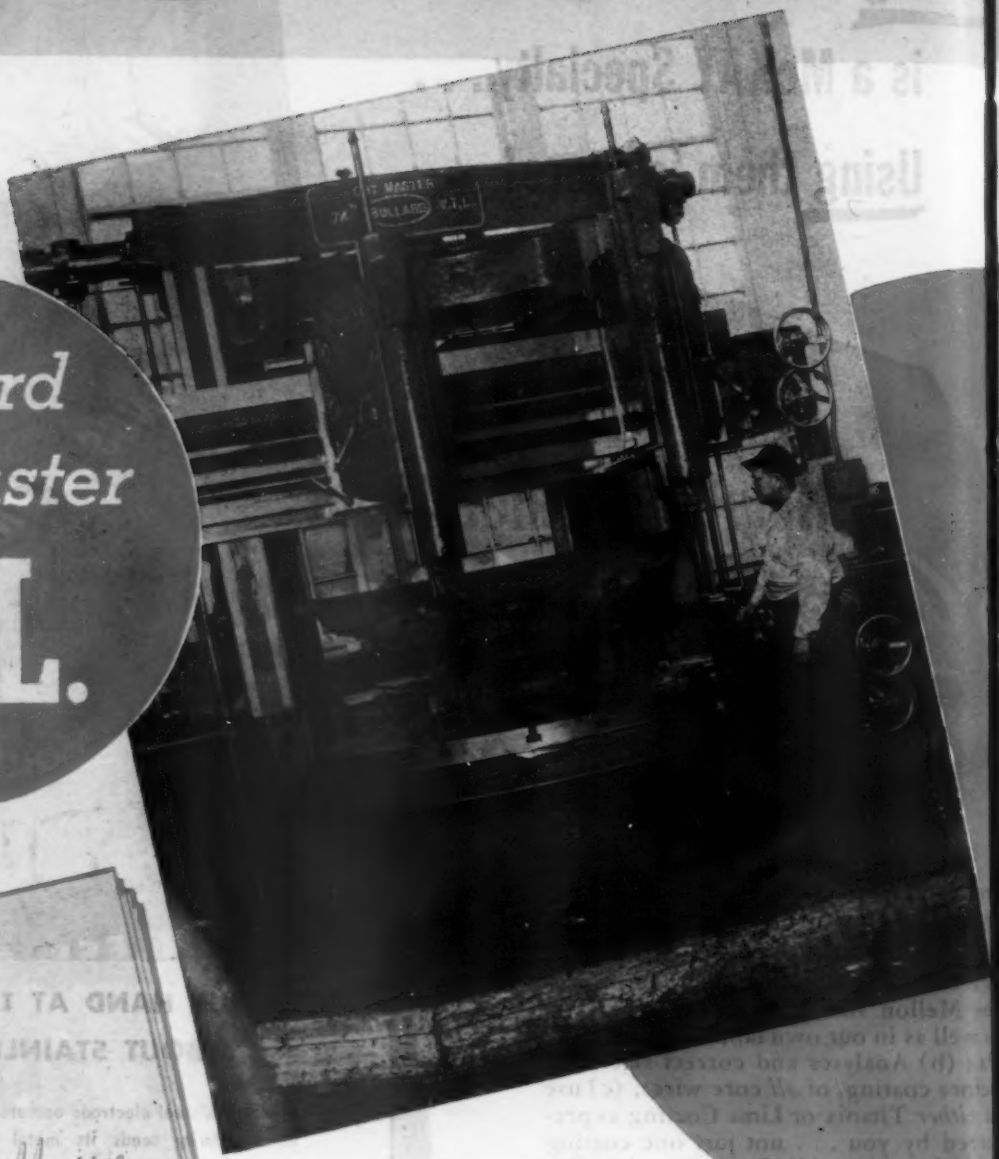


General Sales Office: York, Pa.

THE McKAY COMPANY
PITTSBURGH, PA.

WELDING ELECTRODES . . . COMMERCIAL CHAINS . . . TIRE CHAINS

Ready for Your



Bullard Cut Master V.T.L.

With a Bullard MAN-AU-TROL V.T.L. you can economically machine long runs or single units . . . can protect yourself against changes in specifications . . . can give yourself a tremendous cost advantage in competitive markets. For complete details, write today for new bulletin on the new Bullard MAN-AU-TROL V.T.L.

★ ★ THE BULLARD

BRIDGEPORT 2

r Requisitions

New Bullard Units with Automatic Controls

BULLARD engineers have always pioneered in the design and progress of Vertical Turret Lathes. Every railroad shop supervisor is familiar with their precision and economical production.

In spite of the tremendous demands from industries engaged in war production, Bullard engineers have been working on many improvements which will revolutionize present practice in the machining of many locomotive parts.

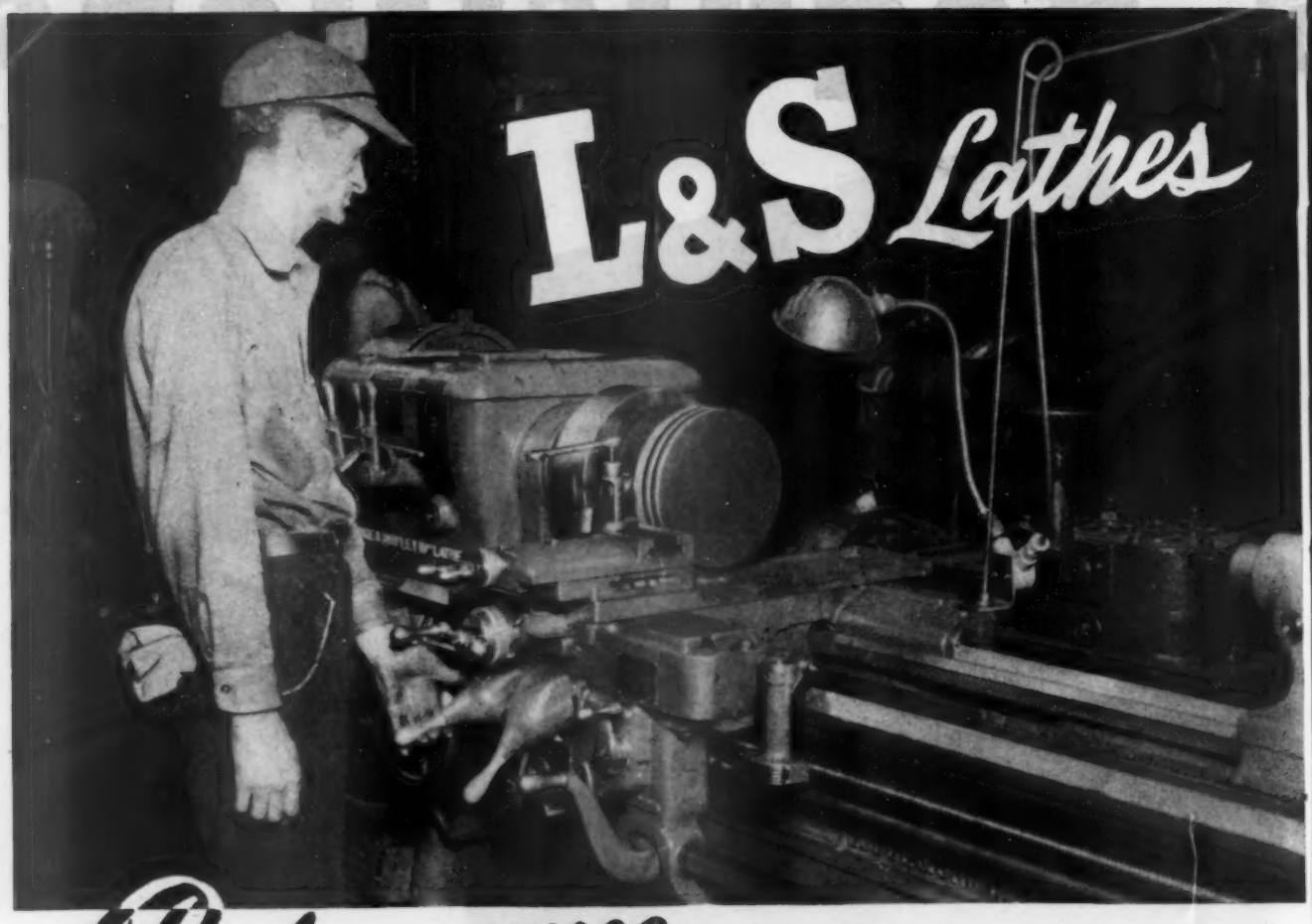
The Cut Master V.T.L. has made a big hit in a number of large shops. It possesses many features which offer unusual savings in production costs.

These features include greater power, faster speeds, greater variety of feeds, more cutting heads, simplified controls, automatic stops and many other new developments.

—And now a new addition has been made to the Bullard line—the Man-Au-Trol V.T.L. It will automatically perform any and every job (involving up to 39 functions of the main head and 39 additional functions of the side head) that a manually-operated V.T.L. can do. Further, it is equally facile as a manually operated machine.

RD COMPANY ★ ★

2 CONNECTICUT



Performance A BIG FACTOR FOR THE INCREASING DEMANDS FROM RAILROADS

THE fact that so many L. & S. Lathes are being installed in leading railroad shops is very significant. All machine tool committees base their selection on precision and production characteristics.

Above illustration shows one of the most recent railroad shop installations. It has been in service just exactly three months. At present it is temporarily installed in a department which handles repairs for the entire system on water pumps and air compressors for power houses, engine terminals and pump houses.

It is a 16" L. & S. Tool Room Lathe and the tool room is waiting for the day when it is moved to their department. The job shown on the L. & S. is a 10½" cast iron piston head.

The line of L. & S. Lathes covers practically all railroad shop requirements. From the largest axle lathes down to the smallest tool room lathes you will find the answer to your production problems in L. & S. construction, design and workmanship.

ENGINE
AUTOMATIC
TOOL ROOM
OIL COUNTRY
LATHES

THE LODGE & SHIPLEY MACHINE TOOL CO

CINCINNATI, 25, OHIO, U. S. A.

L & S LATHES

improve your C.E.*

***CUTTING EFFICIENCY—**
the evaluation of work actually done by a chipping hammer

It pays off in dollars and cents to improve your C. E. Let us assume that a chipping hammer operator earns approximately $2100.00 per year. Since chipping hammers are used almost continuously by the operator, the cost of labor on a job goes down as the efficiency of the hammer goes up. Thus, in the course of a year, an increase in the overall C. E. of only 10% on one chipper means a saving of $210.00 in labor alone. This is equivalent to the original cost of 3½ new chipping hammers. Poor C. E. can be blamed on several factors: poor maintenance—low air pressure—improper tool selection—lack of suitable C. E. test procedure, etc.

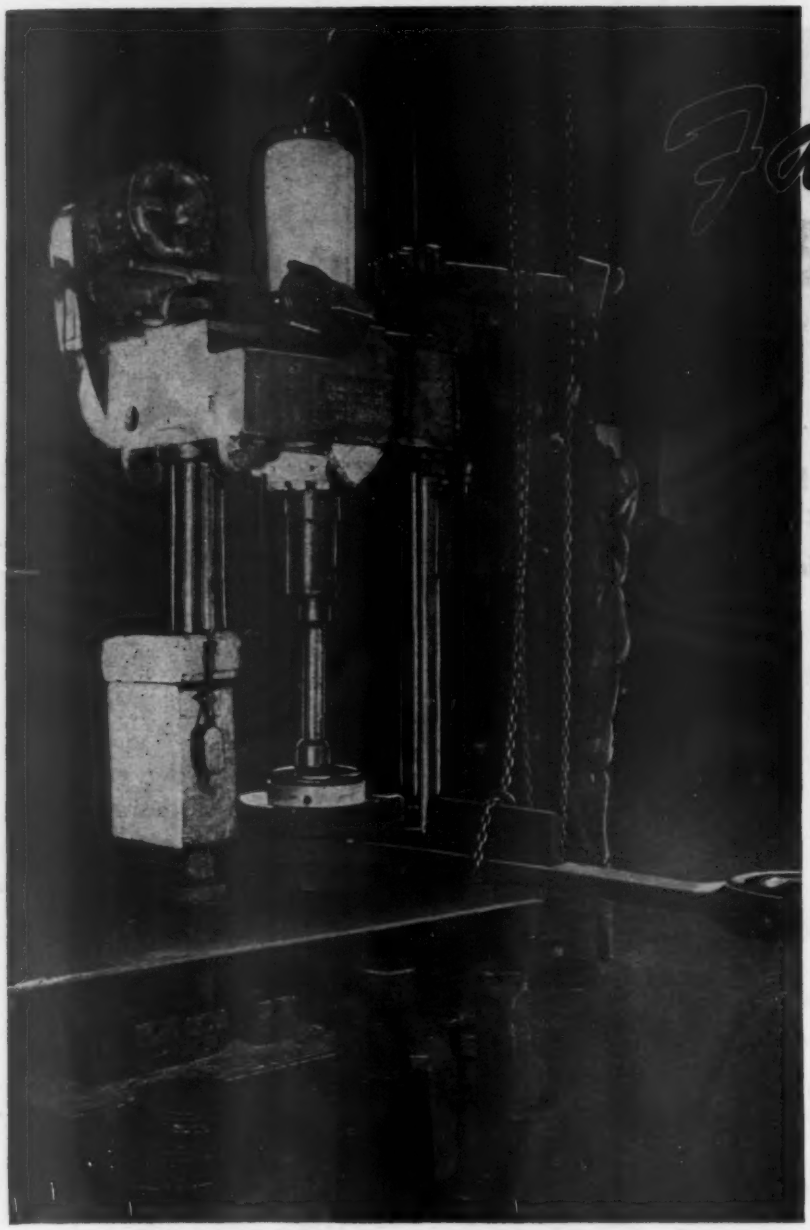
Whether you have one or one hundred chippers, our "cutting efficiency service" is available to you. An I-R service engineer will gladly call and make recommendations for maintaining the highest C. E. at all times. This includes instructions to repairmen for installing and repairing tools—setting up standard C. E. tests—checking air pressures, etc.

Send for a copy of our two-color Chipper Repair Chart, Form 5634.

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.

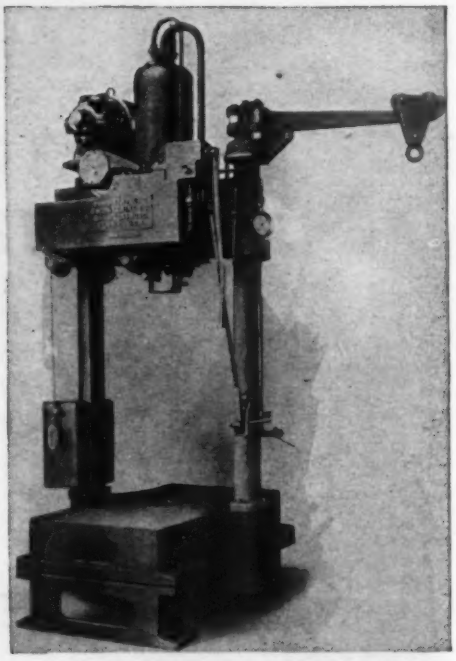
8-561

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL AND GAS ENGINES



Fast Work on BUSHINGS, BRASSES, etc.

Chambersburg Vertical Hydro-Pneumatic Bushing Presses are the most rapid machines available for inserting or removing connecting rod bushings, driving rod brasses, etc., and for bending or straightening rods, levers and all types of connections.



In addition to the speed of operation due to the pneumatic rapid traverse, the press is so designed that simplicity and ease of control make it a favorite with shop men. The ram, for example, can be advanced, stopped or returned without distracting the operator's attention from his work. Pressures can be applied and held indefinitely. Maintenance is easy and inexpensive.

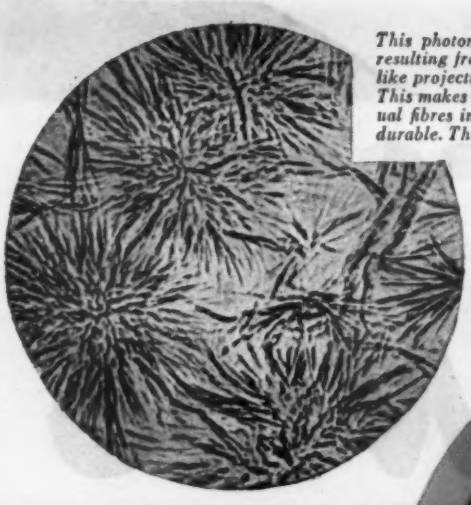
Write for complete information on this and other Chambersburg Railroad Shop Tools . . .

CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

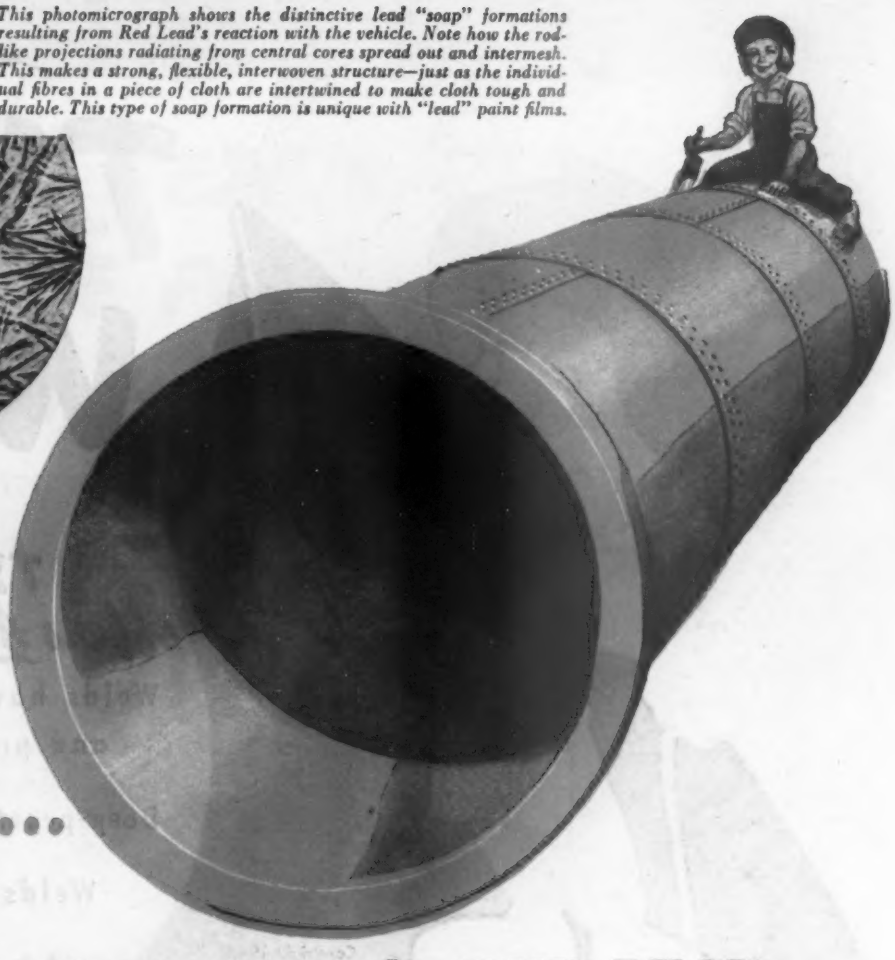
ARMY E NAVY

CHAMBERSBURG

HAMMERS · CECOSTAMPS · PRESSES



This photomicrograph shows the distinctive lead "soap" formations resulting from Red Lead's reaction with the vehicle. Note how the rod-like projections radiating from central cores spread out and intermesh. This makes a strong, flexible, interwoven structure—just as the individual fibres in a piece of cloth are intertwined to make cloth tough and durable. This type of soap formation is unique with "lead" paint films.



unique LEAD SOAPS...

another important reason why RED LEAD means Extra Rust Protection

Why is Red Lead outstanding as a metal protector?

One of the major reasons is this pigment's remarkable ability to impart to the paint film strong, tough, intertwining lead "soap" formations—as shown in the photomicrograph above.

These unique lead "soaps" improve the paint film in many ways. For one thing, they form a dense, intermeshing matrix which restricts the passage of water through the film. And rusting does not take place without the presence of moisture.

For another, they *mechanically* reinforce the film, giving it extra *strength* and *toughness.*

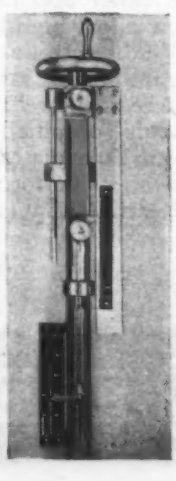
And again, Red Lead "soaps" contribute all-important *elasticity* — allowing movement along their intermeshing projections. This action helps prevent the ruptures to which a hard, unyielding film is subject. Moreover, when a paint film dries and ages, decomposition of the vehicle sets in. But, because of Red Lead's ability to combine with the decomposition products and form soaps, it increases both the durability of the paint film and its adhesion to the base metal.

Red Lead's extra strength, toughness and elasticity are demonstrated by the tensile strength test below and substantiated by exhaustive research and field service.

Remember, too, that Red Lead is compatible with practically all vehicles commonly used in metal protective paints, including phenolic and alkyd resin types.

Specify RED LEAD for All Metal Protective Paints

The value of Red Lead as a rust preventive is most fully realized in a paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint.



* * *

In this tensile strength tester a typical Red Lead paint film has been stretched 18% without breaking. In withstanding this elongation it has maintained a load of 920 grams. Any film that exhibits these characteristics has unusual strength, toughness and elasticity. As metals expand and contract only a fraction of one per-cent, this film would adhere under the most extreme conditions.

No matter what price you pay, you'll get a better paint for surface protection of metal, if it contains Red Lead.

Write for New Booklet—"Red Lead in Corrosion Resistant Paints" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior protection. It also includes typical specification formulas—ranging from Red Lead-Linseed Oil paints to Red Lead-Mixed Pigment-Varnish types. If you haven't received your copy, address nearest branch listed below.

* * *

All types of metal protective paints are constantly being tested at National Lead's many proving grounds. The benefit of our extensive experience with Red Lead paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6, Buffalo 3, Chicago 80, Cincinnati 3, Cleveland 13, St. Louis 1, San Francisco 10, Boston 6 (National-Boston Lead Co.); Pittsburgh 30 (National Lead & Oil Co. of Penna); Philadelphia 7 (John T. Lewis & Bros. Co.); Charleston, W. Va. (Evans Lead Division).

DUTCH BOY RED LEAD

TYPE W-56

Only TYPE W-56 offers ALL these features

Welds have excellent surface and profile appearance

●

Deep-penetrating, spray-type arc

●

Welds in all positions

●

A-c or d-c operation

●

SPECIFICALLY designed for welding carbon-molybdenum steels, in all positions, this new G-E electrode can also be used successfully on other low-alloy, high-tensile materials. W-56 is the *first* electrode to meet all of the requirements of AWS Classification E7010/E7011. And it makes possible, for the first time, the use of *either* a-c or d-c for all of these applications. Even more important, the recognized advantages of the a-c welding process are now made available to industry for high-quality welding of low-alloy, high-tensile steels in the vertical and overhead positions.

Type W-56 Welds Exceed Specifications

Heavily covered, Type W-56 provides a steady, spray-type, deep-penetrating arc which produces a weld of superior quality and excellent appearance. Its light, friable slag is readily removable and sets up rapidly, facilitating welding in the vertical and overhead positions.

Although Type W-56 is designed for use in all positions, its superior welding qualities are most noticeable when it is used in the vertical. The bead obtained is relatively flat, with smooth uniform ripples. X-rays of plates welded in the vertical position are exceptionally clean, and the mechanical properties of specimens are well above specification requirements.

Test Type W-56 Yourself

If your welding work includes the fabrication of pressure vessels (fittings), pressure piping, or other applications involving the welding of low-alloy, high-tensile steel, try the new Type W-56 electrode. Ask your G-E arc-welding distributor for samples and see for yourself the increased welding production and superior welds obtainable with this newly developed rod. Your distributor can also provide you with detailed performance data. Or, write General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

673-57C-N748

THE FIRST E7010/E7011 ELECTRODE FOR WELDING LOW-ALLOY, HIGH-TENSILE STEELS

This single-pass fillet, made in the vertical position, illustrates the deep penetration and excellent fusion obtained with Type W-56.

Of carbon-moly steel, this transformer radiator assembly being welded in the vertical position is typical of the applications for which Type W-56 was designed. Either a-c, as in the illustration, or reverse polarity d-c can be used.

RANGE OF MECHANICAL PROPERTIES

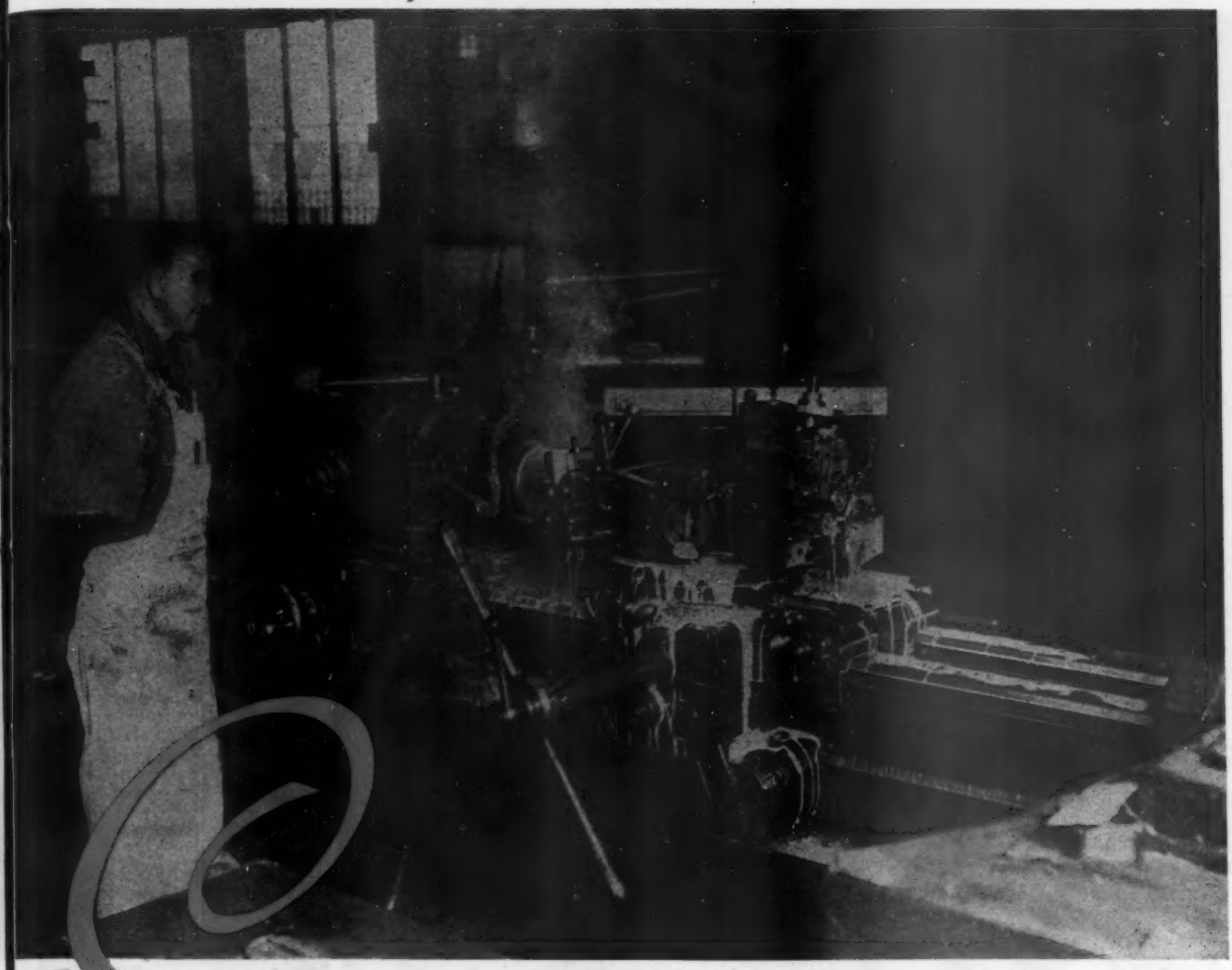
(Stress Relieved)

	Alternating Current		D-c Reverse Polarity	
1/8-in. Diameter				
Tensile	76,000	78,000	73,000	73,000
Yield	60,000	62,000	56,000	58,000
Elongation % 2 in.	26.0	28.0	27.0	28.0
Reduction %	67.0	73.4	62.5	71.4
5/32-in. Diameter				
Tensile	70,700	72,500	73,000	71,000
Yield	54,500	57,500	59,500	57,500
Elongation % 2 in.	28.0	29.0	26.0	25.0
Reduction %	69.0	67.0	67.0	64.5
3/16-in. Diameter				
Tensile	75,500	76,500	72,000	73,500
Yield	61,200	62,500	58,000	57,000
Elongation % 2 in.	32.0	30.0	28.0	29.0
Reduction %	68.0	67.0	64.5	67.0

GE

ARC WELDING ELECTRODES AND EQUIPMENT

Buy all the BONDS you can
—and keep all you buy



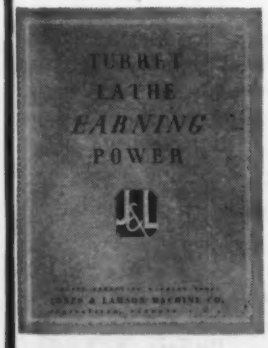
Economy starts with modernization

To Modernize, with Jones & Lamson Universal Turret Lathes, is to Economize.

All the essentials for fast, economical turret lathe production are built into these machines. Rigidity, Speed, Power and Ease of Operation are combined in them to take full advantage of modern fast-cutting tools with minimum fatigue to the operator.

A complete line of Universal Turret Lathes, with from 1½ inches to 8 inches bar capacity, is available for railroad maintenance and shop requirements.

Our book, Turret Lathe Earning Power, will tell you more about the productive advantages of these machines, and will be sent to you upon request.

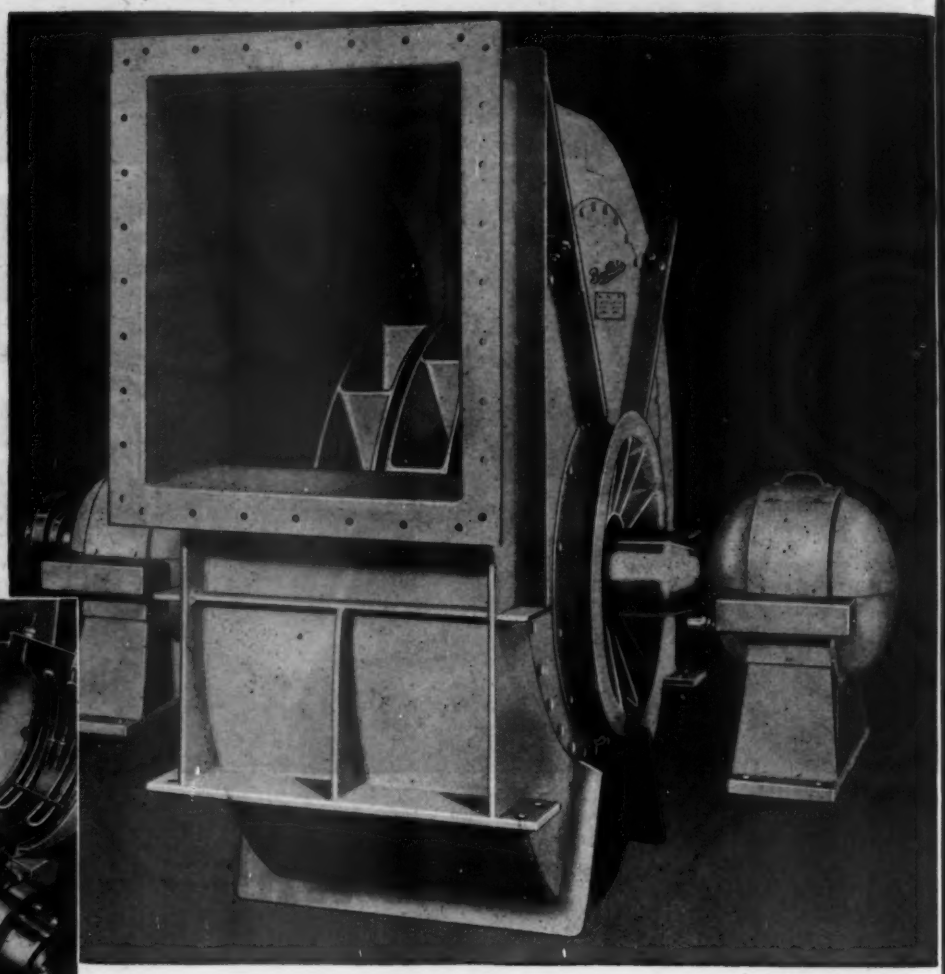


JONES & LAMSON
MACHINE COMPANY
Springfield, Vermont, U.S.A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

Handling Air at 100° Below Zero

Sturdy construction is combined with high efficiency in this special Buffalo low temperature fan. Small illustration shows Calrod-lined bearing cover lifted. Lower part of bearing cover is also lined with Calrod.



When you're flying at 40,000 feet, it's important that instruments function properly, that motors operate smoothly—that valves and meters respond as they should. In order to check all this equipment before it's in the air, testing laboratories reproduce stratosphere conditions on the ground.

"Buffalo" fans have been chosen for circulation of air in many of these laboratories.

The special Buffalo fan illustrated above is for one of the latest and most complete testing plants. Designed to handle 62,400 cfm at 4½ lbs. (equivalent to 120 inches of water pressure) this fan must also handle a temperature range from 100° above zero to 100° below. While the 200° differential is nothing exceptional, many commercial jobs having a much wider range, the low temperature involved produced interesting lubrication problems. To give proper bearing performance SKF oil-lubricated bearings were used. To keep bearing-oil fluid, Calrod heating coils have been placed in a special bearing cover which is arranged for easy inspection.

When your fan problems call for an unusual degree of engineering ability, let Buffalo engineers make recommendations.

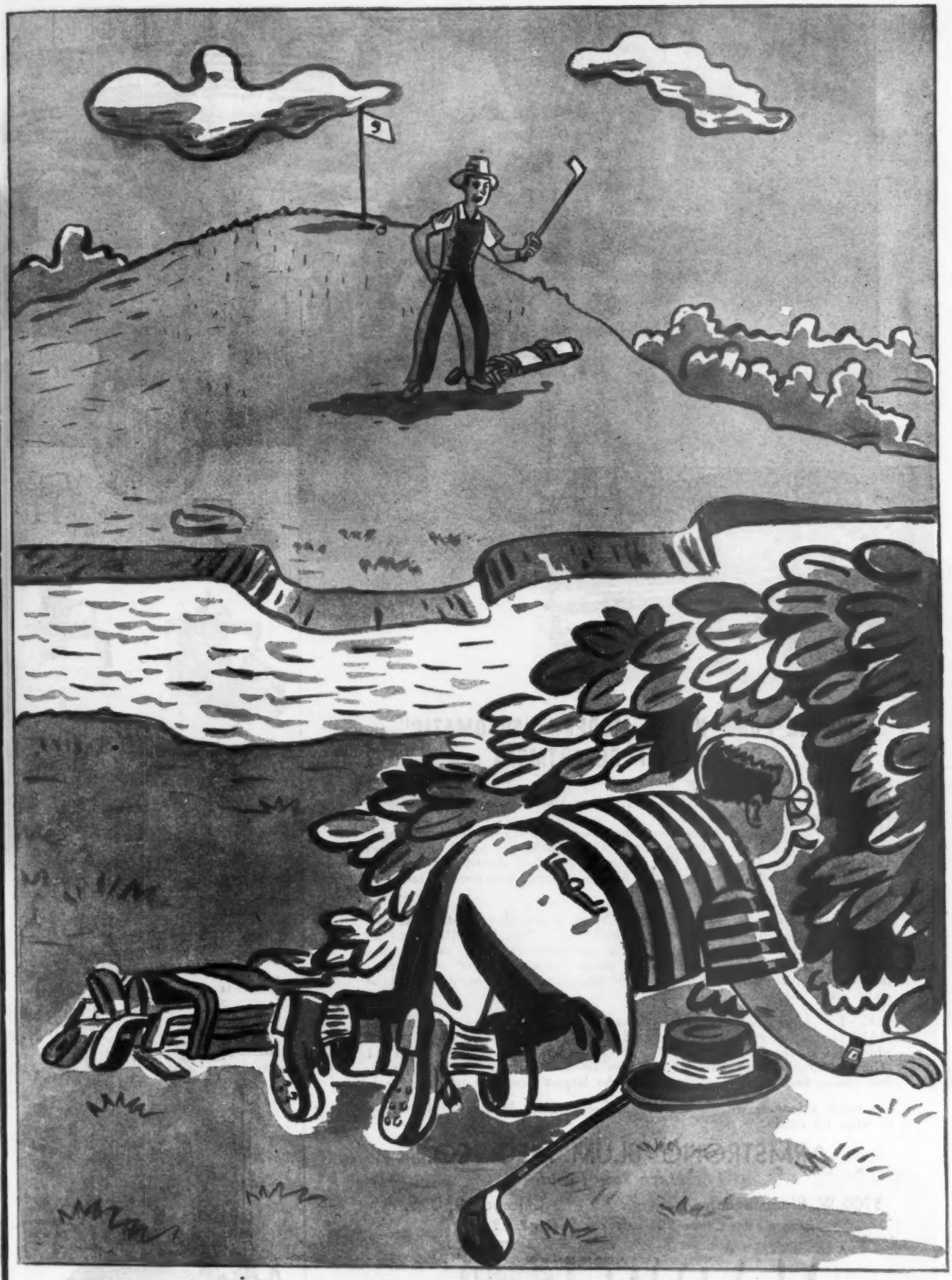
BUFFALO FORGE COMPANY

174 Mortimer St. Buffalo, N. Y.

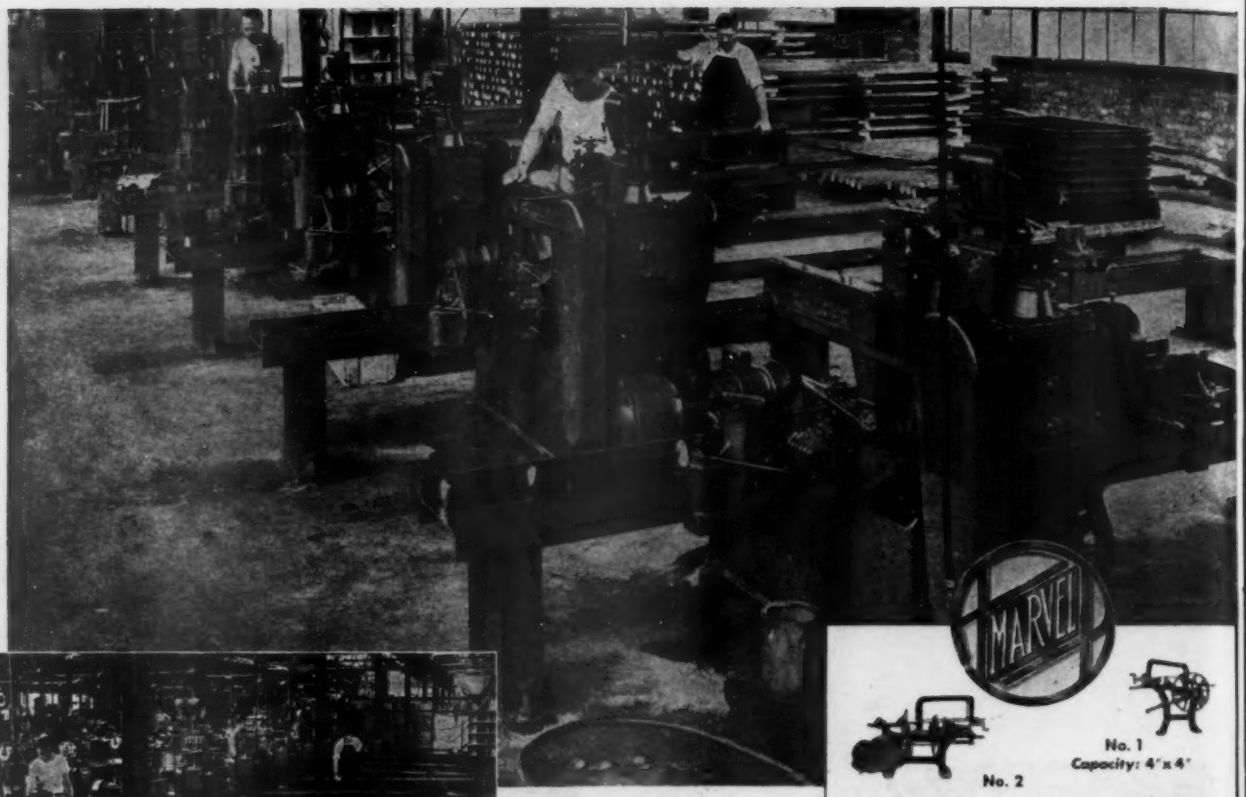
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

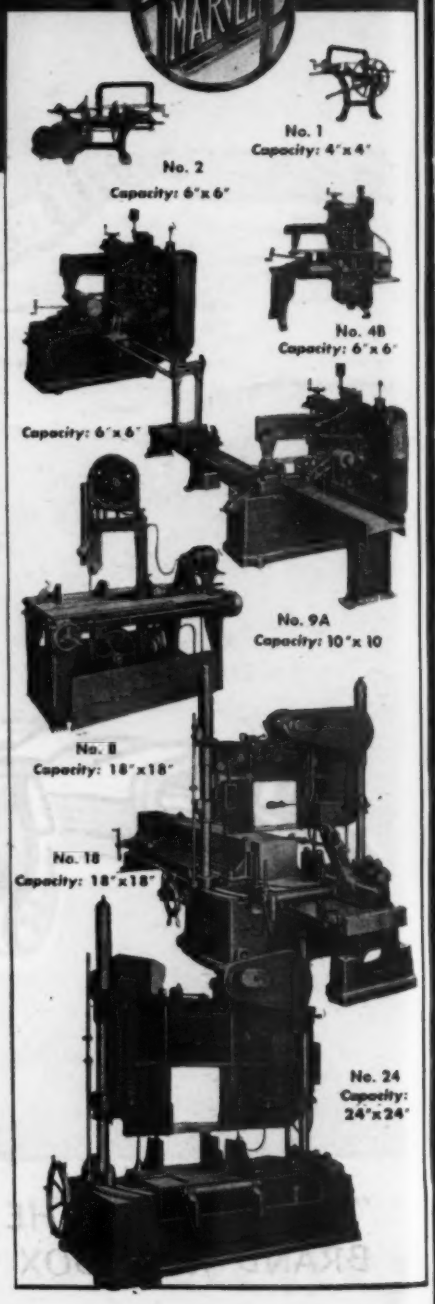
"Buffalo" "First for Fans"

fans *for* industry



"I CAN'T FIND THE BALL, BUT HERE'S SOMETHING BETTER—A BRAND NEW BOX OF **CHAMPION WELDING ELECTRODES!**"





WAYNE PUMP HAS A MODERN "AUTOMATIC" CUTTING-OFF DEPARTMENT

Here is an efficient cutting-off department—a battery of nine high-speed No. 6A MARVEL Automatic Bar Feed Hack Saw Machines, which are supplied from an adjacent stock pile by an overhead monorail system. These MARVEL "Automatics" have been continuously cutting-off accurate lengths from 3½" and 3 3/16" diameter bars (WD 4150 M hot rolled steel) since 1942. With only 3 operators this "automatic" cut-off department has been able to keep ahead of not only the Waynes's large ordnance contracts but their various subcontract jobs as well.

Under this continuous "pounding", at wartime speed, these "world's fastest" hack saws have proven "practically trouble free." Day in and day out for over three years they have continued to automatically feed, measure, and accurately cut-off endless numbers of pieces from single or nested bars, tubes and shapes with no more operator attention than is required by automatic screw machines.

MARVEL Automatic Production Saws come in two sizes, the No. 6A MARVEL, capacity 6" x 6" (pictured above), and the No. 9A MARVEL which has a capacity of 10" x 10". For larger size work the new MARVEL "Giant Hydraulic Hack Saws" (capacities 18" x 18" and 24" x 24") are the first choice because they easily handle the largest sizes and toughest steels.

For quick reference see our section in Sweet's File—Mechanical Industries, or write for catalog.

ARMSTRONG - BLUM MFG. CO.

"The Hack Saw People"

5700 W. Bloomingdale Ave. Chicago 39, U. S. A.

Eastern Sales Office: 225 Lafayette St., N. Y. 12, N. Y.

MARVEL SAWS

Here's simple, low cost production for contouring structural parts on railroad cars!

RAILWAY car carlings... window sash... trim ... in fact, any extruded, rolled or sheet metal part that must be contoured to exact dimensions —can be produced at unusual over-all cost savings by the Hufford method!

Complex shapes or curves, length of part or type of material are no problem. Tooling for production is extremely simple and low in cost—expensive single or double-acting press dies are not required. Uniform, completely accurate parts are produced at a cost-per-piece that is small even when only low production runs are necessary.

The Hufford contouring method can be applied throughout the railroad car building field—wherever metal parts must be curved—and is an important aid in facilitating construction of streamlined designs.

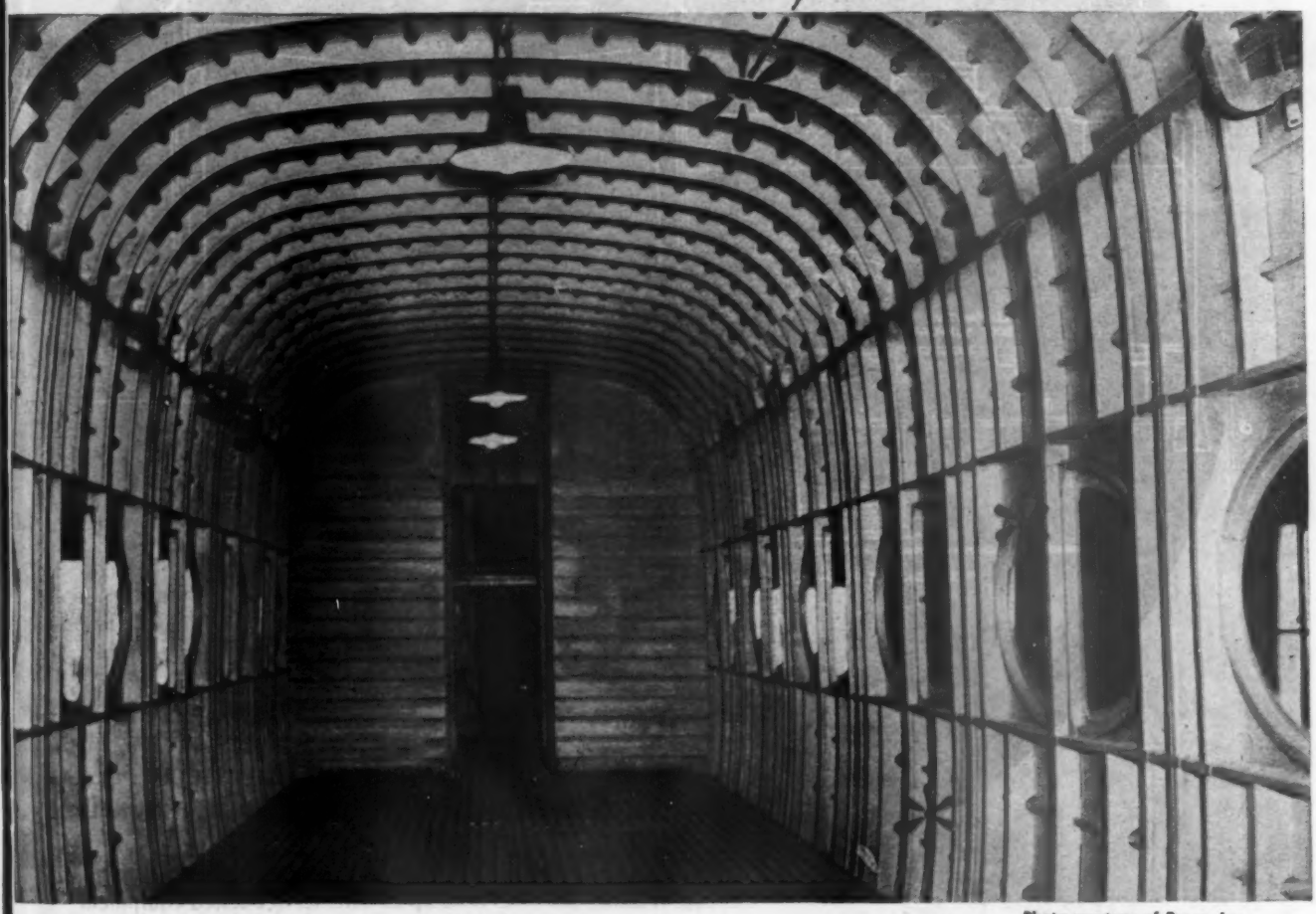


Photo courtesy of Preco, Inc.

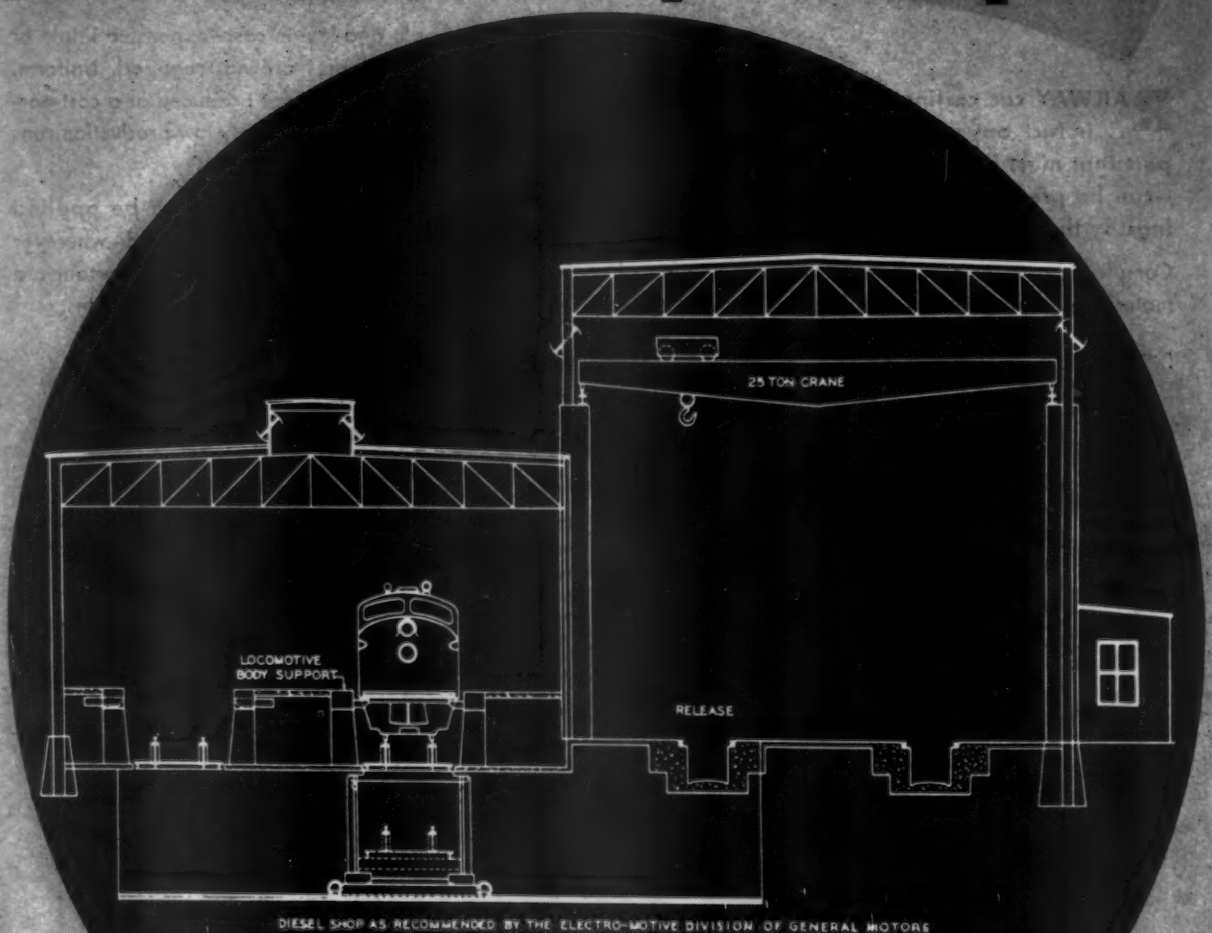
LET OUR ENGINEERS HELP YOU! They will be glad to explain the Hufford contouring method in detail, and make recommendations to fit your problem. A folder containing detailed engineering data, types of parts produced and specifications is yours for the asking. Write for your copy today... ask for descriptive Bulletin R-2.

Hufford Machine Works, Inc., 207 North Broadway, Redondo Beach, California.

Hufford MACHINE WORKS, INC.

MANUFACTURERS OF HYDRAULIC METAL-CONTOURING EQUIPMENT

Do you know the kind of shop your Diesel-electric power requires?



DIESEL SHOP AS RECOMMENDED BY THE ELECTRO-MOTIVE DIVISION OF GENERAL MOTORS

Check with Whiting for specialized equipment for your Diesel-electric shop

1. Drop pit tables
2. Locomotive body supports
3. Side shift tables
4. Washers
5. Hoists
6. Jacks
7. Cranes
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WHITING CAN SUPPLY COMPLETE DIESEL-ELECTRIC MAINTENANCE EQUIPMENT FOR LARGE AND SMALL TERMINALS

Efficient, time-saving maintenance equipment is essential if you wish to realize the full availability of your Diesel-electric power. To this end, Whiting provides both up-to-date, service-tested equipment and a complete engineering service to assist you in the solution of special problems. Write for information.

Transportation **WHITING CORPORATION** *Division*

15609 Lathrop Avenue, Harvey, Illinois

RAILROAD MAINTENANCE EQUIPMENT

DROP PIT TABLES • LOCOMOTIVE HOISTS • HIGH-LIFT JACKS • LOCOMOTIVE SPOTTERS CAR WASHERS • CINDER CONVEYORS • TRANSFER TABLES • CROSSOVER BRIDGES

Offices in Chicago, Cincinnati, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, and Washington, D. C. Agents in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario.

In the making

Illustrating how ALX Cast Alloy Tool Bits are poured on a centrifugal spinner. The metal is weighed first to assure filling the mold without insufficiency or waste.

On the job

A 7/16" ALX Tool Bit roughturning a Type 309 (25-12) stainless steel forging of 4-1/4" diameter, taking a 1/8" cut at a speed of 140 feet per minute, with a feed of .020".

Announcing ALX CAST ALLOY TOOL BITS — FAST CUTTING NON FERROUS TOOL BITS CONTAINING BORON

OUR most recent development in the field of cutting materials, ALX Cast Alloy Tool Bits, is the result of complete and thorough research investigation in the Allegheny Ludlum Laboratories, and exhaustive machining tests in the field.

Produced by advanced methods of centrifugal casting, ALX Alloy is a highly homogenous metal, with consequent advantage in cutting properties. It possesses high hardness in the as-cast condition, requiring no further heat treatment. In performance, ALX rates between carbide metal-tipped tools and high speed steel. It rounds out and completes the Allegheny Ludlum line of cutting materials—which includes Carmet carbide metals and a wide selection of high and low-tungsten and "moly" high speed steels—giving us the utmost range in supplying the tools best fitted for each individual job.

Ground and finished ALX Cast Alloy Tools, both in solid and tipped bits, are available in a complete range of sizes from our own and distributors' warehouse stocks. They fully merit serious investigation and comparative testing on your cutting jobs. The assistance of our Mill Service Staff is at your entire disposal • Also available is a new and complete bulletin on ALX Tool Bits, giving full data on selection and performance. *Write for your copy.*

Address Dept. RME 34

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

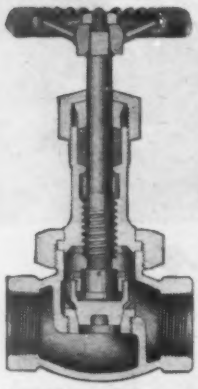
W & D...9795

Need A. A. R. valves and fittings?
. . . choose from the CRANE line

ONE SOURCE OF SUPPLY • ONE RESPONSIBILITY • ONE STANDARD OF QUALITY

300-Pound A.A.R. Brass Globe and Angle Valves

INSIDE SCREW TYPE

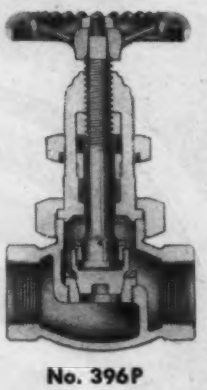


No. 376P

Made with plug or ball type disc, in sizes from ¼ to 2 in. female inlet and outlet, male or female inlet with female union outlet. Body is Crane Special Brass; bonnet of highly wear-resistant bronze. Seating materials in plug type disc valves are—Monel metal to Exelloy in sizes up to ½ in.; Nickel Alloy to Exelloy in sizes ¾ in. and larger. In ball type disc valves: Monel metal to Exelloy in sizes up to ½ in., while ¾ in. and larger have both disc and seat ring of Nickel Alloy. For complete specifications, see page 42 of your Crane Catalog.

300-Pound A.A.R. Brass Globe Valves

OUTSIDE SCREW AND YOKE

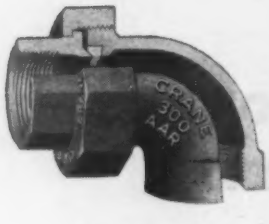


No. 396P

These valves come in sizes from ½ to 2 in., and have the famous hard-wearing, leak-resisting Crane plug type disc with Nickel Alloy to Exelloy seating materials. For extra strength in the stem, Crane uses 18-8-Mo Chrome Nickel Alloy Steel. Body is Crane special Brass; with Cast Manganese Bronze in the bonnet. Parts of these valves are interchangeable with Crane A. A. R. inside screw globe valves except stem, bonnet, gland and gland nut. See page 44 of your Crane Catalog for complete specifications.

A.A.R. Malleable Iron Unions and Union Fittings

WORKING PRESSURE: 300 Pounds Steam, 550° F.

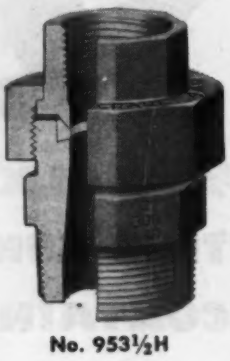


No. 890E

Here are female end or male and female unions, 90° or 45° elbows, and tees with union on either run or outlet end. In straight sizes from ¼ to 3 in. Reducing tees in sizes up to 1 x ¾ in. Reducing (air pump) unions up to 2 x 1½ in. These fittings have brass-to-iron ground joint seat. Steel tailpiece fittings have brass-to-steel ground joint seat, and provide additional strength under severe working conditions. See pages 242, 243, 244 of your Crane Catalog.

A.A.R. Forged Steel Ground Joint Unions

WORKING PRESSURE: 300 Pounds Steam

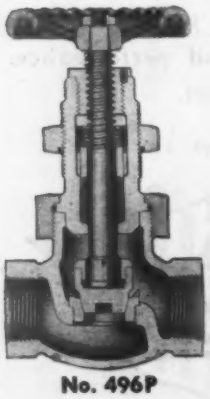


No. 953½H

With ground joint, brass-to-steel seat, these unions are made in female end and Reducing Air Pump patterns with larger male end. Extra rugged. Recommended for locomotive and car piping subjected to vibration, expansion and contraction. Corresponding parts interchangeable with other Crane A. A. R. unions. Female end pattern sizes, ¼ to 3 in., reducing type, 1¼ x 1 to 2 x 1½ in. See page 244 of your Crane Catalog.

600-Pound Alloy Cast Steel Globe Valves

OUTSIDE SCREW AND YOKE



No. 496P

Working Pressure: 600 lbs. Steam, 750° F.

Patterned after A. A. R. 300-Pound O S & Y Brass Valves. Designed for high pressure superheated steam service on locomotives. Have wide-bearing plug type disc and seat, ideal for throttling, with No. 49 Nickel Alloy-to-Exelloy seating materials. Body and bonnet are Crane No. 4 Carbon-Molybdenum alloy steel; with Exelloy stem. Made in sizes from ½ to 2 in., with female inlet and outlet, male or female inlet with female union outlet. See page 311 of your Crane Catalog.

FOR RAILROADS

. . . a truly complete piping materials service

In addition to A. A. R. lines, Crane serves the railroads with the world's most complete selection of valves, fittings, pipe, piping specialties and fabricated piping —in Brass, Iron, and Steel—for all applications in shops, power houses, service buildings, stations and on rolling stock. Consult your Crane Catalog—or Crane Branch or Wholesaler.

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas*

CRANE

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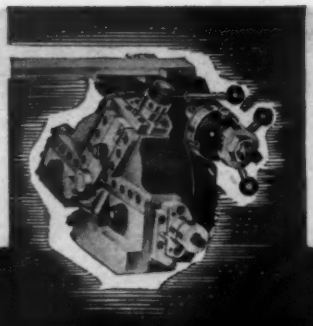


Fast, Accurate Production

with the new Warner & Swasey Taper Frame Bolt Turner

Turning a locomotive frame bolt with a Warner & Swasey Taper Frame Bolt Turner on a Warner & Swasey 1A Universal Turret Lathe. Setup does not interfere with other tools in the hex turret used for normal turning operation of the turret lathe.

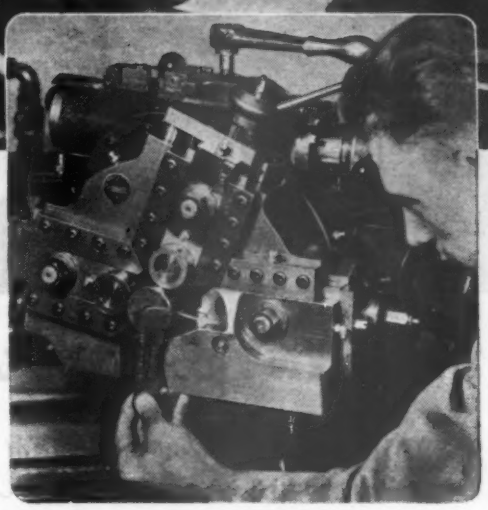
RAILROAD shops are called upon to produce locomotive taper frame bolts and other accurate taper jobs in volume and on rush order.

With a Warner & Swasey Taper Turner any length or diameter frame bolt can be turned, ready to drive in a few minutes. *Only one cut is required to turn the taper—accurately and to size.*

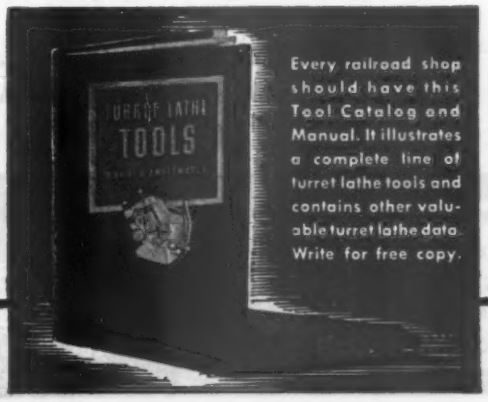
Size to be cut is controlled to extreme accuracy by direct reading scale and dial adjustment.

Other tools in hex turret stations are free for other turning jobs without wasting time for new tooling setups. Warner & Swasey, Cleveland, Ohio.

WARNER & SWASEY
Machine Tools
Cleveland



It's easy to set a new or reground cutter on center. Adjustments for different diameter sizes are quickly made by setting scale and dial indicators.



Every railroad shop should have this Tool Catalog and Manual. It illustrates a complete line of turret lathe tools and contains other valuable turret lathe data. Write for free copy.

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS ...WITH A WARNER & SWASEY

ENGINEERS . . . PRODUCTION MEN

Get this *New Free Book* on BLIND RIVETING!

THIS comprehensive illustrated manual explains in detail the unique operating principles of the Huck Blind Rivet and the advantages provided by this design—advantages proved by wide application in aircraft construction and similar fields. *Complete instructions and data* are given for selecting the proper rivet length, drilling and dimpling the material, driving the rivets, and inspection of driven rivets from the accessible side of the work. Other sections cover operation of the rivet gun and removal of driven rivets.

Only HUCK Blind Rivets Offer *ALL* These Advantages

1. **Positive shank expansion to fill the hole—assures a rigid, fatigue-resistant joint capable of withstanding vibration and reversals of stress.**
2. **Bulbed blind head formation—pulls sheets tightly together; provides adequate surface contact between blind head and sheet, giving great strength and rigidity.**
3. **Positive mechanical lock—rigidly and permanently locks rivet pin to sleeve; gives driven rivet a strength comparable to that of a *solid* rivet.**
4. **Automatic pin break, flush with outer head—no trimming required.**
5. **Quick, easy driving. Jaws of gun hold rivet rigidly centralized; rivet can't wobble, fall out, or move so as to cause improper engagement of the pin by the gun jaws. Complete driving operation is very rapid and requires only one operator.**
6. **Simple and fast inspection of driven rivets—by merely examining the manufactured head on the accessible side of the work.**

Free illustrated manual gives full details

Written particularly for engineers and production men, this new manual will be of interest to everyone concerned with sheet metal assembly problems. *Send for your free copy today*—on your company letterhead, please.

Huck MANUFACTURING CO.

2480 BELLEVUE AVENUE **DETROIT 7, MICHIGAN**

ADVANTAGES OF AJAX FORGING MACHINES in Conjunction with Hammers and Forging Presses

Dies and tools for upsetting stock for press or drop-forged jaw.

Upsetter dies for punching pin and tap size holes in drop-forged shackle.

Many forgings require the balling up of stock on the ends of bars to provide sufficient volume of metal to fill the impressions of the hammer or press dies. This operation can be done faster and more economically on Ajax Air Clutch Forging Machines than by drawing or fullering the shank from large stock.

On other forgings, the upsetter can be used to supplement the press or hammer for punching holes, trimming flash, ironing out draft or upsetting flanges which cannot be formed in the press or hammer dies.

Write for Bulletin No. 65-B

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
621 MARQUETTE BUILDING · CHICAGO 3, ILLINOIS

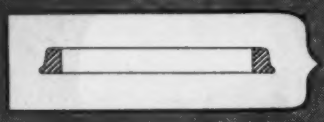
For MAXIMUM MACHINING ECONOMIES in your shops

use

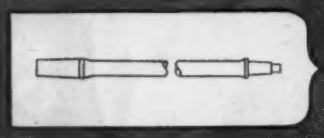
KENNAMETAL

STEEL-CUTTING CEMENTED CARBIDE TOOLS

TYPICAL APPLICATIONS

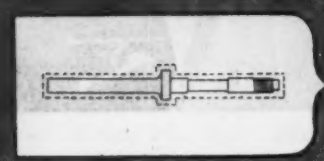


BORING & TURNING LOCOMOTIVE TIRES

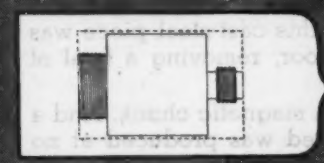


TURNING PISTON RODS

TURNING FRAME BOLTS



MACHINING PISTON VALVE STEMS



MACHINING CROSS HEAD WAIST PINS

MACHINING SMALL PARTS

STYLE 12 HD HEAVY DUTY TOOL WITH CLAMP-ON ADVANCEABLE KENNAMETAL BLANK

Kennametal—the steel-cutting carbide invented in America—makes practicable higher surface speeds, longer tool service between resharpenings, and exceptionally extended tool life. Furthermore, roughing and finishing cuts may often be taken simultaneously with Kennametal-tipped tools. The resulting economies in machining time and tooling costs are essential to the efficient operation of a modern railroad mechanical department.

The accurate work made possible with Kennametal tools is of equally great importance. Kennametal is tough, hard, durable—it "peels off" the metal, instead of scraping it away. Kennametal-tipped tools bore driving wheel tires straight and true, without taper, and produce a mirror-smooth finish that minimizes possibility of fatigue failures that may develop from minute fractures caused by "scraping" tools. They are equally distinctive for the other steel-cutting jobs illustrated at the left.

Kennametal now costs less than one-tenth of what it did when introduced. Catalog 44 lists the latest prices, and describes the newest technique in high production carbide machining. A copy will be sent upon request.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL Inc., LATROBE, PA.

FACE GRINDING SAYS "SO WHAT?" TO CAST STEEL

A FEW OF THE RAILROAD JOBS YOU CAN DO FASTER AND BETTER WITH A DIAMOND FACE GRINDER:

- Guides
- Chafing Plates
- Lateral Clevis Blocks
- Wedges
- Reverse Links
- Engine Truck Pedestals
- Spring Saddles
- Valve Cross Heads
- Plates and Guides
- Air Pump Cylinders
- Steam Pipe Joints
- Flat Spring Hangers
- Shear Knives
- Engine Truck and Trailer Boxes
- Engine Truck Cellars
- Spring Equalizers
- Link Blocks
- Locomotive Pedestal Caps
- Pedestal Cap Filler Blocks
- Eccentric Cranks

Most locomotive parts like this main driving box are being made of cast steel. But cast steel or cast iron make no difference to the Diamond Face Grinder. For example, this cast steel piece was faced 2 sides in 28 minutes floor-to-floor, removing a total of 9/16" stock.

No special fixtures were used, only a magnetic chuck. And a better finish than was formerly obtained was produced at no additional cost. Had the piece been designed for face grinding much less time would have been required.

Write for new Bulletin 44-G at once. See for yourself how many types of work you can face better and faster on a Diamond Face Grinder.

MAIL TODAY FOR NEW FOLDER

Diamond Machine Company of Philadelphia
2510 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Please send me promptly your Bulletin 44-G which shows how to speed-up production with the Diamond Face Grinder.

Name _____ Title _____

Company _____

Address _____ State _____

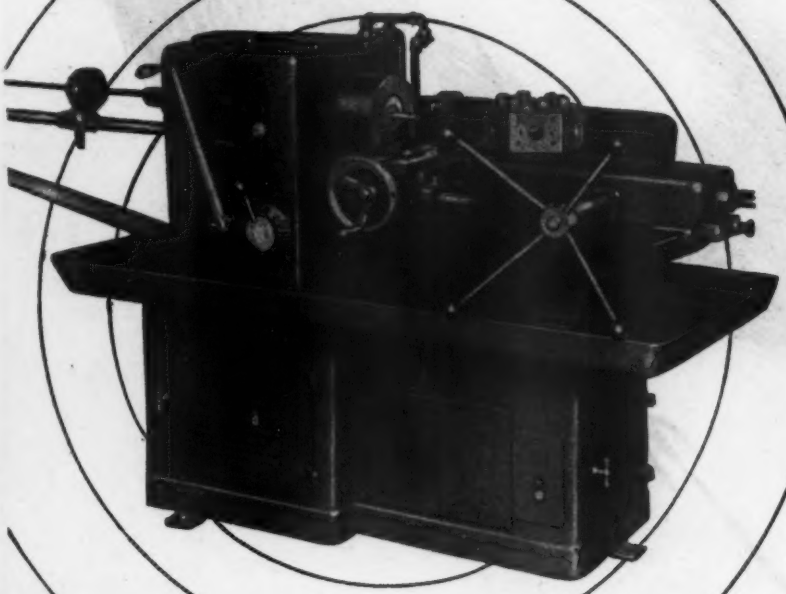
City _____

"THE DIAMOND D THAT CUTS YOUR COSTS"

DIAMOND
MACHINE COMPANY
OF PHILADELPHIA

Subsidiary of American Engineering Company, manufacturers of A-Taylor and Perfect Speed Systems, Maidea Dock Auxiliaries, Le-Hed Hoists, Helo-Shaw Fluid Power.

ADDED FEATURES



EXPAND ITS USES

New developments have expanded the scope of uses for the Oster No. 601 "RAPIDUCTION" lathe.

Throughout the war, this *SIMPLIFIED* machine has made it possible for many companies to train new workers quickly to high standards and release highly skilled operators to more complicated machines.

Although low in price, the No. 601 "RAPIDUCTION" is actually a "custom-built" machine with optional features to meet specific requirements. Examples are the two types of drive, either WORM drive or DIRECT drive; and the automatically indexed, six-station turret or the plain saddle with single tool post.

Now, with the additional developments outlined briefly at the right, the Oster No. 601 "RAPIDUCTION" offers greater values than ever.

1 New 4-speed motor permits four speed changes without change of sheaves. (2-speed motor optional.)

2 Motor is mounted on oil-resistant rubber to insure smooth, quiet operation.

3 Individual ⅛ H.P. motor now operates coolant pump to provide uniform flow of lubricant, independent of spindle speeds.

4 New electrical controls have speed selector switch located conveniently for the operator.

5 Increased rigidity of the machine is insured with longer base of heavier construction.

MEMORANDUM

Automatic Chuck Capacity of the Oster No. 601 "RAPIDUCTION" lathe remains unchanged: 1½" round bar; 1⅛" square bar; 1⅜" hex bar.

Inquiries are invited but deliveries are uncertain due to conditions beyond our control.

OSTER

"Rapiduction" LATHES

THE OSTER MANUFACTURING COMPANY • 2030 EAST 61ST STREET, CLEVELAND 3, OHIO, U. S. A.

In Cleaning...

Uncontrolled Action = Danger!

Controlled Action = pH

In chemical cleaning and processing, which is our business, as in everything else where the natural laws of chemistry and physics are involved, action and reaction should be kept under control.

An industrial cleaning compound must have real strength with plenty of reserve power to do a good job consistently, day after day; but added strength is not always the answer to unsatisfactory results. You need the *right kind of strength* held in at the exact degree of cleaning power which is best for the particular job in hand. This calls for an accurate method of control—Kelite pH Control!

By constant adherence to the pH chart, which accurately measures the cleaning power needed for every type of soil removal and shows the exact limits of safety for the surface being cleaned, Kelite has taken the guesswork out of chemical cleaning and processing . . . provided *the key to maximum efficiency.*

Take a look at that operation you've been worrying about. If you think it might be handled with a little more speed or agility . . . if you think costs may be running higher than absolutely necessary . . . if the present method seems rough on the surfaces being cleaned or processed . . . call in your local Kelite Service Engineer. Let him show you how the application of pH Control can assure speed, economy and safety in cleaning.

Wherever there's dirt, grease, grime, scale, corrosion or any undesirable deposit or contamination, Kelite materials with pH Control can solve the cleaning problem.

Executive Offices: 909 East 60th Street, Los Angeles 1. Manufacturing plants in Los Angeles, Dallas, Chicago, and Perth Amboy. Branches in principal cities. "Kelite" Reg. U. S. Pat. Off., Chart copyrighted 1942 by Kelite Products, Inc.

KELITE

SCIENTIFIC CLEANING THROUGH pH CONTROL

KELITE pH Control

COMPARE the prices of Standard Carboloy Tools with those of ordinary tools

. . . then compare results

★ Available at prices as low as 70c each—actually lower in price than many sizes of ordinary tools—Carboloy "Standards" are a *"must"* on any tooling program!

Compare the prices of Carboloy "Standards"—then compare the *recognized* results of their use! With Carboloy "Standards" you can quickly increase production, often doubling or tripling machine output; save machines and manpower; reduce your tool inventory; step-up tool life to unprecedented periods of continuous use; obtain a quality of finish that substantially reduces polishing time; and effect a marked reduction in cost per piece produced.

These outstanding advantages are *immediately* available to you when you specify Carboloy "Standards". Stocked for prompt delivery in 10 styles, all common sizes, for cutting steel, cast iron, non-ferrous and non-metallics.

CARBOLOY COMPANY, INC.
11157 EAST EIGHT MILE ROAD DETROIT 32, MICHIGAN
CHICAGO • CLEVELAND • HOUSTON • LOS ANGELES • MILWAUKEE
NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON
Also Sold by Leading Mill Supply Distributors

Increased Production!
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Machines and Manpower Saved!
•
Long Tool Life!
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Better Finish!
•
Lower Cost per Piece!
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Lower Tool Inventory!
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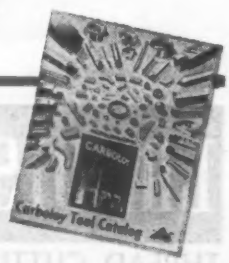
Improved Product Quality!

CARBOLOY
(TRADE-MARK) CEMENTED CARBIDES
STANDARD TOOLS

Send for Catalog GT-175R



THE LANDMACO THREADING MACHINE ASSURES MINIMUM OPERATING COSTS

The Landmaco Threading Machine is a precision tool capable of handling your threading operations economically. It is geared for high threading speeds with resultant maximum production.

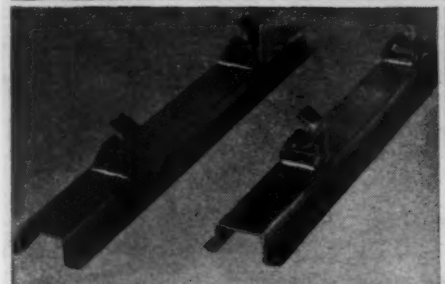
Its many exclusive features assure the greatest possible degree of accuracy, ease of operation and flexibility in making set-up changes.

Write for Bulletin No. H-75

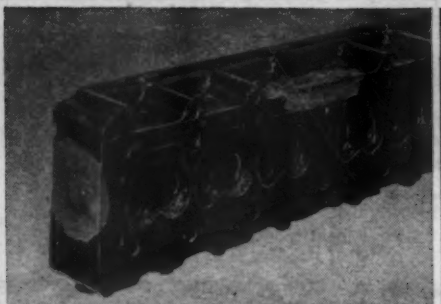
LANDIS MACHINE COMPANY, WAYNESBORO, PENNA, U.S.A.

THREAD CUTTING MACHINES • DIE HEADS • COLLAPSIBLE TAPS • THREAD GRINDERS

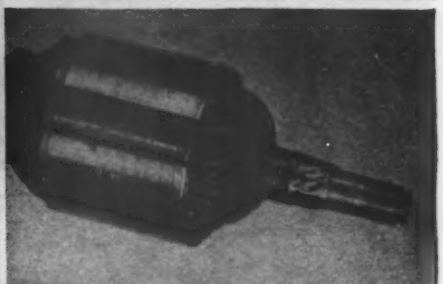
AVOID WELDING DISTORTION STRESSES AND OVERHEATING



Arc welding bombsight hanger on frame member of plane produced severe warping and misalignment. Eutectic Low Temperature Welding prevented distortion and formed strong joints.



Cast iron motor heads are safely repaired without danger of subjecting to stresses, eliminating need for costly and lengthy after machining always necessary to correct distortions.



Worn motor armature shaft resurfaced by Eutectic Low Temperature Welding completely avoiding warping of shaft and preventing destruction of windings by excessive heat.

WITH EUTECTIC

EUTECTIC (Pronounced U-tec-tic) Reg. U.S. Pat. Off.

Low Temperature WELDING RODS

Every day—there are jobs that can be done *better* the EUTECTIC way. *Try it today!*

Castolin Eutectic

Bond metals at temperatures as low as 340° F. Reduce heat consumption . . . cut welding costs

Now, without resorting to high temperatures, you can gain the advantage of the strong bonds formed by fusion welding.

The most revolutionary welding development of modern times—EUTECTIC *Low Temperature* Welding enables you to join metals at temperatures below the fusion points of base metals.

Eutectic welding rods and fluxes are available for joining all metals by means of gas—arc—induction—furnace and all standard methods of heating.

Try Eutectic for Production—Salvage and Maintenance welding.

EUTECTIC WELDING ALLOYS COMPANY • 40 WORTH STREET, NEW YORK 13, N.Y.

☐ Send me full information for purchasing *introductory assortment* of important Eutecrods for Production Salvage and Maintenance welding.

☐ Please send me The Eutectic Catalog FN-1 containing complete information about Eutectic Low Temperature Welding and its 6 great advantages.

Name_____ Position_____

Company_____ Address_____

RETOOLING MAY HAVE TO WAIT...

BUT NOT *Rebuilding*

90" Niles Wheel Lathe being Engineered Rebuilt *by Simmons for one of the country's leading railroads. In foreground, dismantled parts of a similar lathe.*

WHILE retooling for peacetime production awaits only the go-ahead signal to put your blueprinted ideas to work, don't overlook the nucleus of your future production—the overworked machine tools right on your floor, the equipment that must be restored to peak efficiency for economical and profitable operation.

Leading manufacturers are already anticipating this need, taking "physical inventory" of their basic equipment and initiating systematic *Engineered Rebuilding* programs by Simmons.

Engineered Rebuilding goes beyond the mere restoring of a tool to originally designed capacity. Simmons techniques build in new utility and labor-saving devices. Beds and tables are lengthened, housings widened, and special motors and gear transmissions added where necessary.

A new edition of "The Simmons Way" is just off the press. It will answer your questions about the ways and means of *Engineered Rebuilding.* Write for your copy today.

SIMMONS MACHINE TOOL CORPORATION
1825 NORTH BROADWAY, ALBANY 1, NEW YORK

SIMMONS MANUFACTURERS OF STANDARD AND SPECIAL-PURPOSE MACHINE TOOLS • ENGINEERED REBUILDING

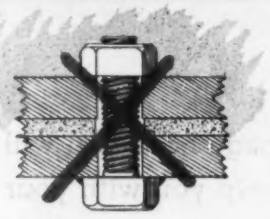
Eliminates drilling and tapping studs– NELSON ARC STUD WELDING!

Automatic stud welding saves time and material. It eliminates the costly operations of drilling, tapping, and hand welding bolts for studs. With the Nelson Stud Welder "flux-filled" studs are *automatically* end-welded to metal instantly. Uniform welds with full-fillet result every time.

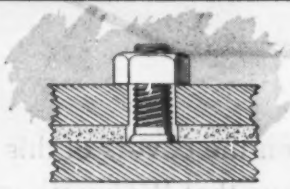
All standard stud diameters from 3/16" to 3/4" are manufactured—all may be welded with the same stud welding unit. A standard welding generator is used. The equipment is portable and may be used effectively in any position or operated as a production unit from a fixed jig. (Multi-gun units are available for special production jobs.) More than 700 industrial plants and shipyards are using thousands of stud welders in time-saving applications. No previous welding experience is necessary for operators.

The Nelson Stud Welder welding through locating template.

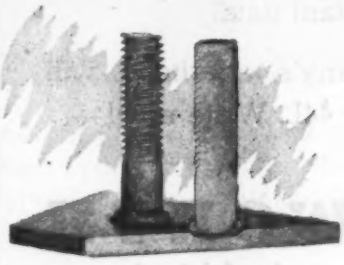
STUD WELDED IN ½ SECOND!



Eliminates hand welding to secure bolt or stud. Unsightly bolt head is omitted.



Instead stud is welded to metal—equal in strength yet saves three or more operations!



Cutaway view of stud weld after etching with Nital.

Complete fusion of stud to metal is obtained—a deep penetration. Fillet not only on outer surface of stud but complete binding through base. Automatic timing control and uniform heat produces these results—consistently and quickly.

For complete details, prices and catalog write:

NELSON SPECIALTY WELDING EQUIPMENT CORP.
Dept. R, 440 Peralta Avenue
San Leandro, California

Eastern Representative: Camden Stud Welding Corp. Dept. 122, 1416 South Sixth Street, Camden, N.J.

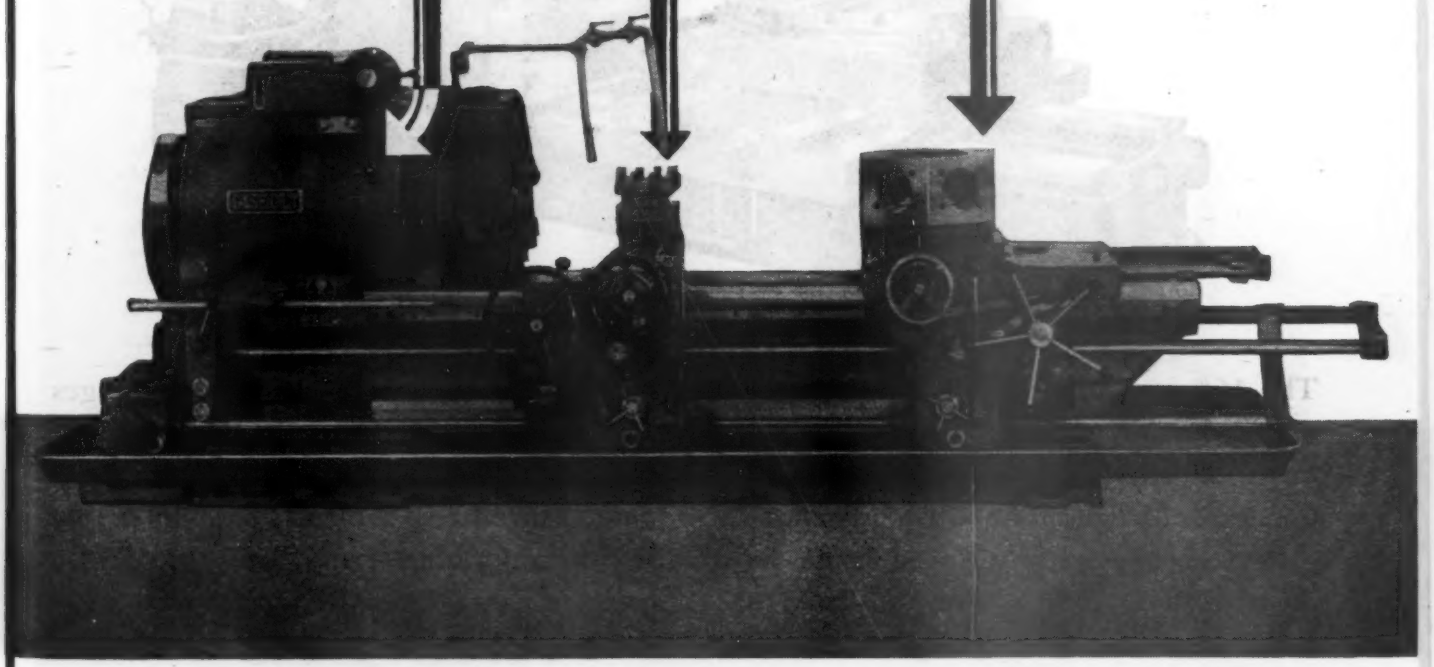
Adaptable . . .

Here's a Gisholt advantage that pays big dividends . . . the ability to handle a broader range of work when the need arises. Take, for example, the Gisholt 4L Saddle Type Turret Lathe. A big machine, to be sure, yet its flexibility and ease of operation enable it to handle smaller work too. Here are a few of the reasons why:

1 Hydraulic clutching and braking make it possible for the operator to start, reverse, or stop the spindle—as quickly and as effortlessly as on many smaller machines. One easy movement of one lever is all it takes. Response is instantaneous, smooth, positive.

2 Power rapid traverse for the side carriage is provided not only for longitudinal movement but also for in-and-out movement of the cross slide. Here's greater ease and speed for bringing tools quickly into cutting position.

3 This massive cross-feeding hexagon turret is more accurate—more adaptable with its 16 reversible feeds and automatic feed trips for both longitudinal and cross feeds. It can be locked rigidly on center for bar work—or chucking work with piloted tools.



Adaptability is a fact that applies to both Gisholt Saddle Type and Gisholt Ram Type Turret Lathes. Make the most of it. Explore the possibilities of each type to assure the most flexible and economical set-up for your own production. Ask for literature.

GISHOLT MACHINE COMPANY • *1293 E. Washington Ave., Madison 3, Wis.*

Look Ahead...Keep Ahead...With Gisholt Improvements in Metal Turning

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

TIME-SAVER ON ALL TYPES OF SLOTTING

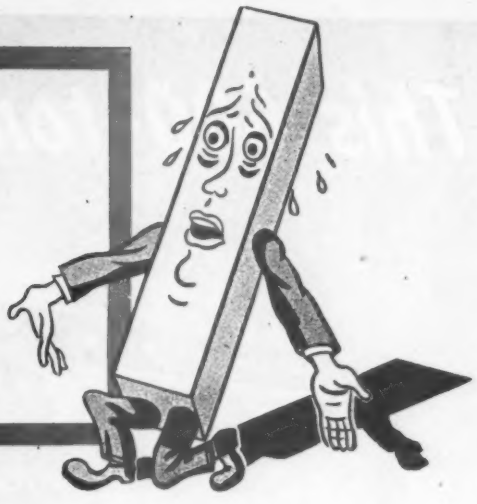
4504

The 36″ stroke Hy-Draulic Slotter speeds up production of big heavy slotting jobs. Powerful and rugged, it is fast, easy to operate, efficient. The early installation shown at upper right saved some 40% on machining crown brass fits. Later machines make similar savings on a wide variety of work.

Some of the Hy-Draulic Slotter features that provide these operating advantages are: power rapid traverse in all directions; start, stop and jog buttons on handy pendant; centralized controls, built-in dividing head, tilting ram. These, and the basic advantages of hydraulic feeds, are described in a bulletin that will be sent to interested executives on request. Please ask for Bulletin 1921.

ROCKFORD MACHINE TOOL CO., ROCKFORD, ILLINOIS

Stop Abusing Your Tool Bits



Users say:
The first real tool holder improvement in 25 years!

Exclusive vise-grip jaw eliminates rocking, because it exerts equalized pressure over *full* length of cutter channel, and not just at one point. Screw-operated jaw runs right to cutting edge and hugs bit so it can't slip, can't sag, can't break!

Holds All Sizes and Shapes

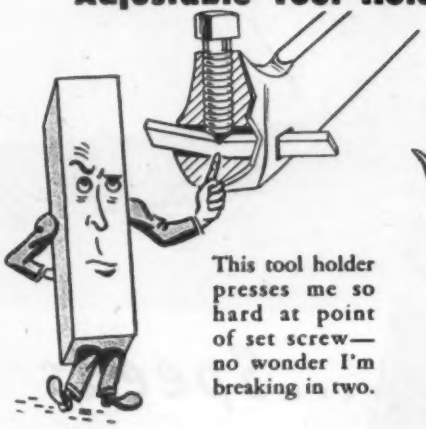
One Clark Adjustable Tool Holder takes 4 or more sizes of square, undersize, round or out-of-round, or narrow tool bits for cutting-off or special forming operations. Short bits and stub ends may now be used up.

For Carbide Tools and Boring Bars

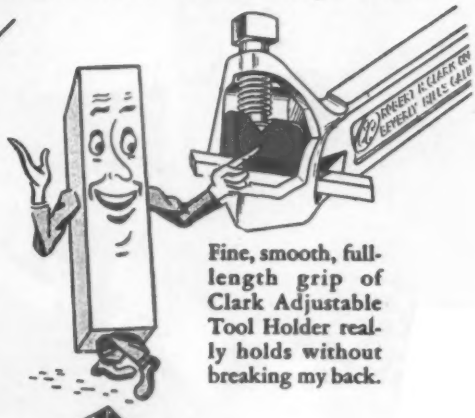
In addition to standard Clark Adjustable Tool Holder with 15° cutter channel, there's the Clark Parallel Tool Holder for better seating and better clamping action on carbide bits, threading tools, and boring bars.

For complete information about Clark Adjustable Tool Holder, call your Clark Cutter Jobber today, or write for catalog RME-7-TH

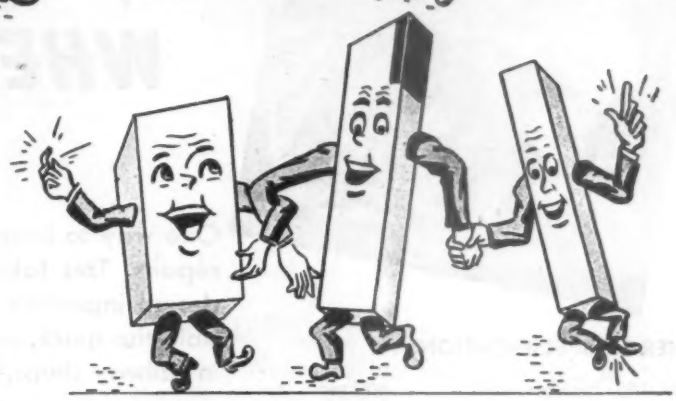
Change Now to Clark
Adjustable Tool Holder with Vise-Grip Jaw



This tool holder presses me so hard at point of set screw—no wonder I'm breaking in two.



Fine, smooth, full-length grip of Clark Adjustable Tool Holder really holds without breaking my back.



SNORT STUBBY

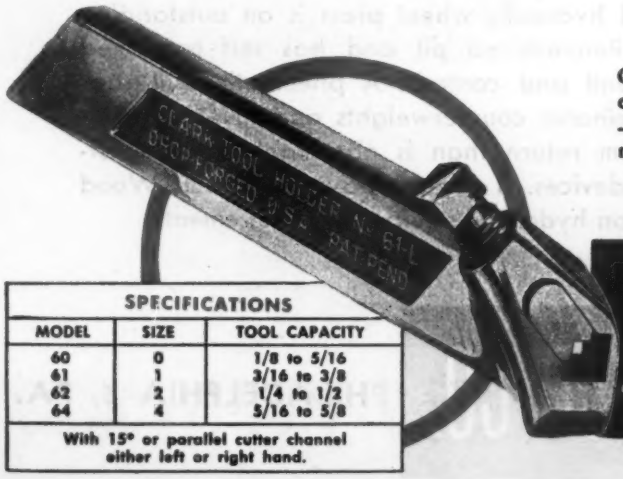
Clark Tool Holder is best for me—adds years to my life!

CARBIE CARBIDE

Boy! I like that extra support right to my cutting edge.

UNDER SIZE

Whee! Now I'm good for cutting-off or other operations.



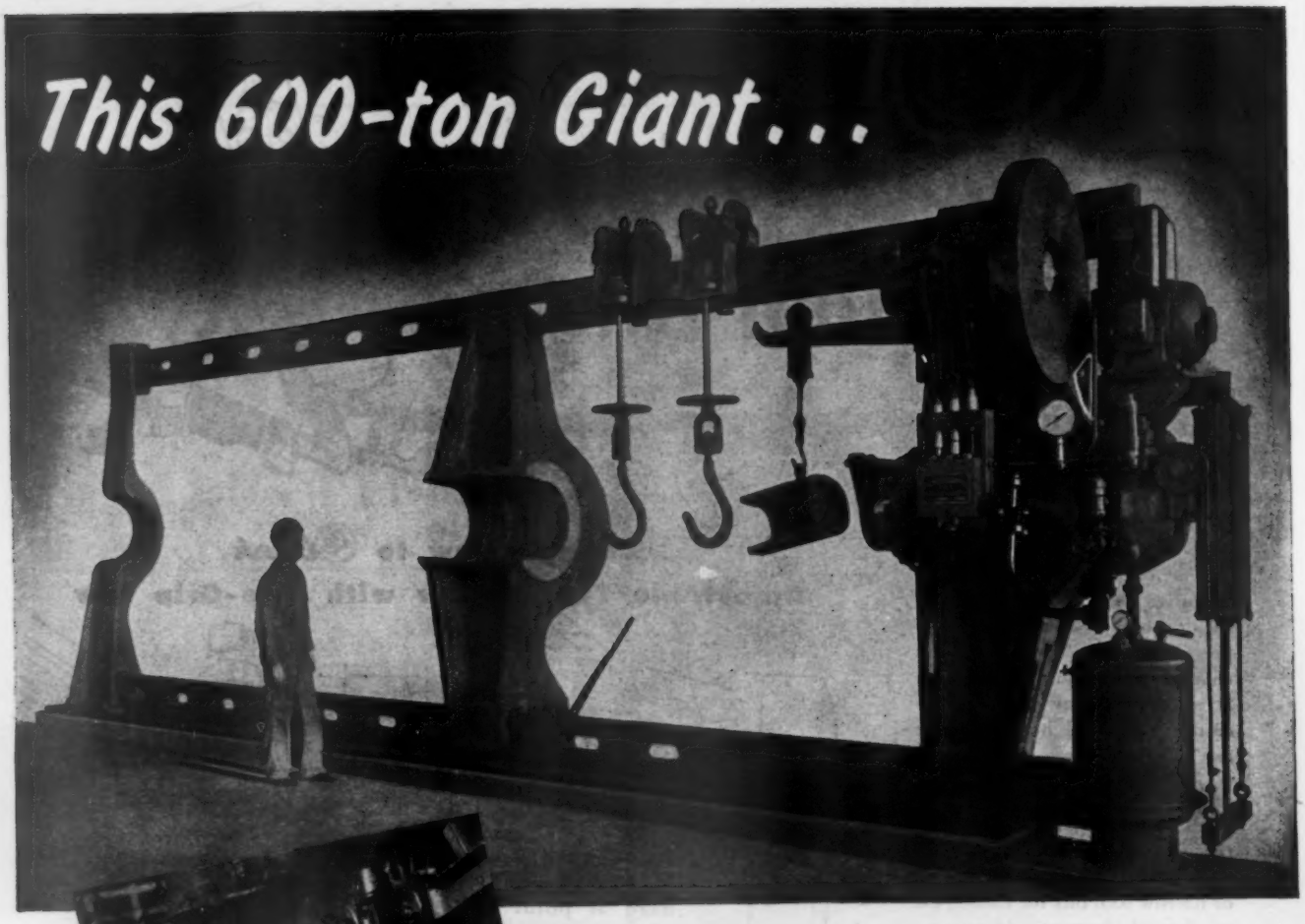
SPECIFICATIONS		
MODEL	SIZE	TOOL CAPACITY
60	0	1/8 to 5/16
61	1	3/16 to 3/8
62	2	1/4 to 1/2
64	4	5/16 to 5/8
With 15° or parallel cutter channel either left or right hand.		

CLARK CC CUTTERS

Robert H. Clark Company

9330 SANTA MONICA BOULEVARD • BEVERLY HILLS, CALIFORNIA

This 600-ton Giant...



...Speeds WHEEL-and-AXLE Maintenance!

One way to keep rolling stock rolling is to speed up repairs. This takes modern equipment. R. D. Wood design ingenuity in hydraulic equipment makes possible the quick, economical performance of vital work in railway shops.

This Wood hydraulic wheel press is an outstanding example. Requires no pit and has self-contained pumping unit and controls. A pneumatic pull-back device eliminates counterweights and gives a faster rate of ram return than is obtainable on ballast-weighted devices. It always pays to consult Wood engineers on hydraulic equipment requirements.

GENERAL SPECIFICATIONS:

CAPACITIES: High pressure . . . 600 tons
Low pressure . . . 100 "

RAM: Diameter 16", Stroke 26"

CLEARANCE: Between bars . . . . . 96"
To resistance post . . . 20"

POWER: Self-contained pumping unit driven by 15 H.P., 1200 r.p.m. motor.

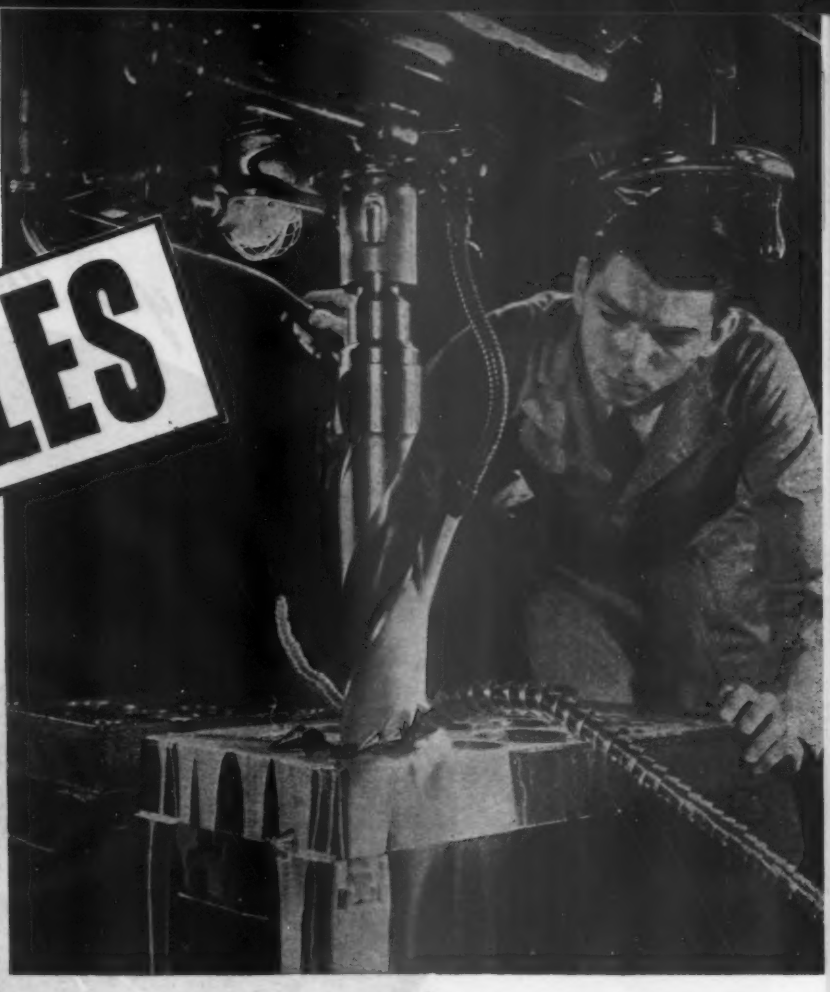
Major castings of normalized O.H. steel and generous use of Meehanite castings including end post, cylinder, ram, plunger heads, etc.

Details sent upon request.

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE...

R. D. WOOD CO. **PHILADELPHIA 5, PA.**

BIG HOLES



LITTLE HOLES

It makes no difference — there's an "AMERICAN" for every job.

"AMERICAN" Hole Wizard Radials are meeting the challenge of railroad shop production without a whimper. Day in and day out in the railroad shops throughout the country they are drilling, boring and tapping at top speed and at the same time are maintaining amazing standards of accuracy.

Railroad shops that have established enviable records for low cost production are using "AMERICAN" Radials.

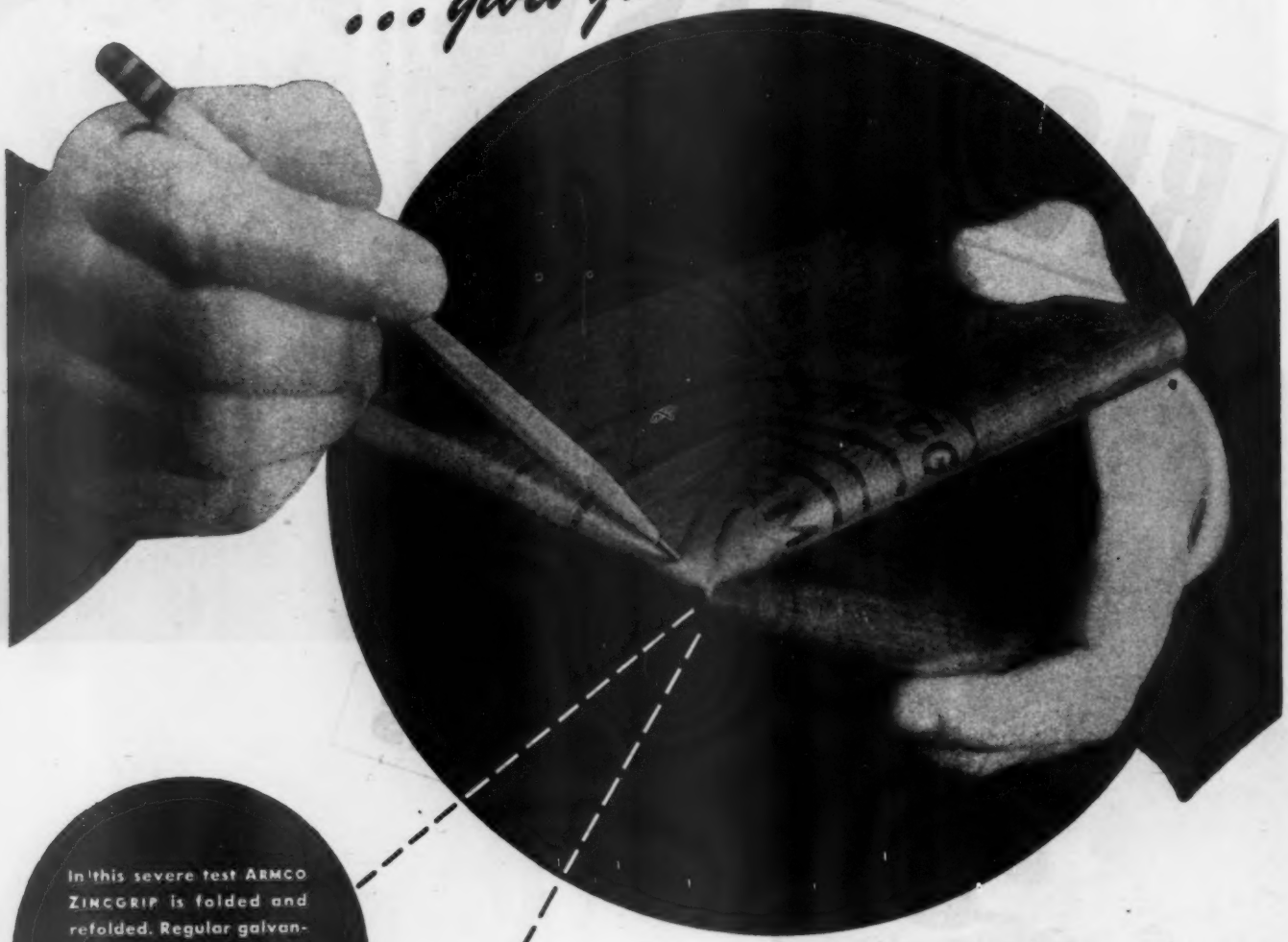
THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills

Zinc S-T-R-E-T-C-H-E-S with the steel...

...gives you unbroken protection



In this severe test ARMCO ZINCGRIP is folded and refolded. Regular galvanized steel would flake badly at the corner to which the pencil points, but the coating on ZINCGRIP remains unbroken.

This is the famous "Handkerchief Test" on ARMCO ZINCGRIP.

It clearly shows how the special zinc coating *stretches* with the steel during severe fabricating operations. This means *unbroken zinc protection* for your passenger and freight car roofs and other parts.

Regular galvanized steel, as satisfactory as it is for many uses, won't take the severe draws or double-lock seaming required for many parts. The zinc coating flakes off, and complete protection is lost. Naturally the equipment doesn't stand up as long in service, costs money to replace.

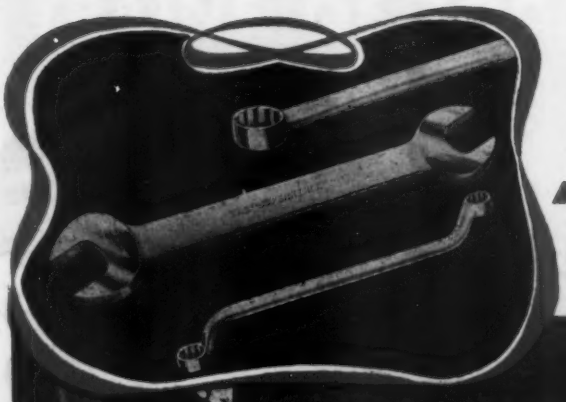
THIS IS THE ANSWER

ARMCO ZINCGRIP solves the problem. Its specially-applied zinc coating clings tightly to drawn corners as well as the flat parts. No bare spots are left for corrosion to feed on.

If your sheet steel car parts need zinc protection, we'd like to tell you more about ARMCO ZINCGRIP.* Just write the Armco Railroad Sales Co. Inc., 1671 Curtis Street, Middletown, Ohio, for our free booklet.

ARMCO
Railroad Sales Co. Inc.

*ARMCO PAINTGRIP, a special Bonderized surface treatment, is recommended for ZINCGRIP products requiring immediate painting.



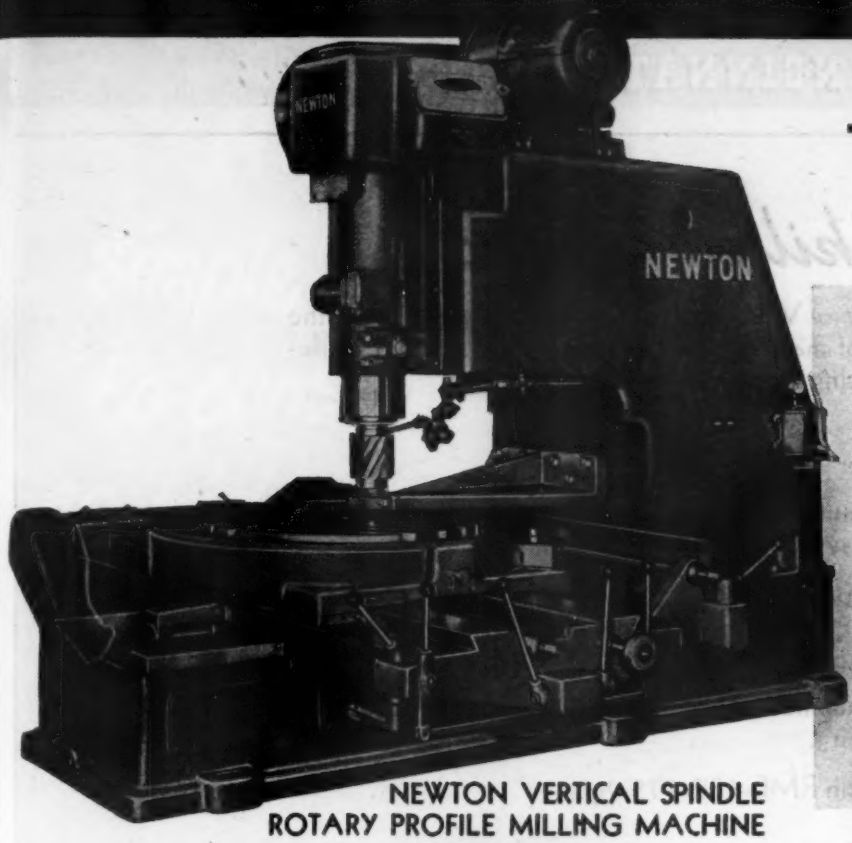
They're easier to reach with
"SUPERRENCHES"

Awkward, hard-to-reach adjustments present no problem for these slim, taper-jawed "Superrenches". Forged from alloy steel, they are thin enough to operate half nuts yet their strength is equal to that of the strongest wrenches made.

Williams "Superrenches" are available in a wide range of patterns, with openings from 3/16" to 3-1/8". When wartime regulations are lifted they again will be furnished in bright chrome finish. Sold by Industrial Distributors everywhere. J. H. Williams & Co., Buffalo 7, N.Y.

WILLIAMS
DROP-FORGINGS AND DROP-FORGED TOOLS

TRAINS OF TODAY RUN ON THEIR MAINTENANCE-MEN AND TOOLS



NEWTON VERTICAL SPINDLE
ROTARY PROFILE MILLING MACHINE

.... and here are two of the tools that help to keep them rolling

The Newton Vertical Spindle Rotary Profile Milling Machine is designed to meet motion-shop profiling requirements. Built in two sizes, one with 32" diameter table and a larger size with 41" diameter table.

The Betts-Bridgeford Three-Carriage Journal Truing Lathe refinishes and burnishes worn journals on car wheel sets without removing the wheels. The third carriage turns and burnishes inside journals. With blocks in place, it serves as an Axle Lathe.

BETTS-BRIDGEFORD THREE-
CARRIAGE JOURNAL TRUING LATHE

ASK THE MAN IN THE RAILROAD SHOP . . . .
HE KNOWS CONSOLIDATED RAILROAD TOOLS

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

A few simple rules to conserve carbide tools

FIRTHITE FIELD SERVICE POSTERS are available for display in your plant

The conservation of carbide tools through proper handling and correct usage is essential not only in war time but at any time for best production results and low operating costs.

These Firthite field service posters will help remind your plant operators in simple, easy-to-take, understandable manner, of the right way to make carbide tools do their utmost.

Fill in and mail the coupon for your set of these free, 17" x 22", four-color posters.

Firth-Sterling
STEEL COMPANY

OFFICES: McKEESPORT, PA. • NEW YORK • HARTFORD • PHILADELPHIA • PITTSBURGH • CLEVELAND • DAYTON • DETROIT • CHICAGO • LOS ANGELES

FIRTH-STERLING STEEL CO., Dept. RME—McKeesport, Pa.

Please send us without obligation on our part _____ sets of Firthite Field Service Posters which we wish to display in our plant shops.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

THE EDITOR'S DESK

REHABILITATING THE VETERAN

The boys are coming home. Many of those who are now being mustered out of service have been physically injured, some of them seriously. They have also had heart-rending experiences, with resulting severe mental shocks. These men are not looking for pity. They are comparatively young and are anxious to find their proper place in our economic and social program. What shall be our attitude toward them? How can we be of the greatest assistance, and particularly to those who are physically or mentally disabled or handicapped? This question has been asked many times and everything depends upon finding the proper answers.

The American Museum of Safety, which sponsors a number of awards for exceptional safety performance, in seeking to find the answers discovered that the Center for Safety Education of New York University was engaged in making studies dealing with the utilization of handicapped persons in industry. To facilitate this program the Museum granted an Arthur Williams Memorial Award for fellowship study, under the direction of the Center for Safety Education. This has made possible an early report in the form of a Safety Training Digest in Industrial Rehabilitation.

This Digest contains findings based upon the rehabilitation practices of 25 industries that have given special consideration to the rehabilitation of the physically handicapped, some of them over a long period and dealing with the most serious types of disability. The best practices of these companies are also high-lighted. John V. Grimaldi, the holder of the fellowship, finds that "when the capacities of the disabled individual are properly matched with the job, the disability ceases to be a handicap".

In referring to the neuropsychiatric veteran he suggests that "when he is returned to his former environment, the exaggerated manifestations of his functional mental-neurological disorder will probably subside". In referring to such cases the Digest also quotes Col. William C. Menninger, director of the Neuropsychiatric Division of the Office of the Surgeon General of the War Department, thus: "None is psychotic and very few are any less capable of holding jobs than before they went into the armed forces."

Copies of the Digest may be obtained from the Center for Safety Education, New York University, 8 Fifth Avenue, New York 11, N. Y., for a nominal price (35 cents for a single copy).

Roy V. Wright

The KING Way

Speeds Crosshead Jobs

ILLUSTRATION shows one of the many recent installations of KING Boring Mills in leading railroad shops.

Only three months in service, this KING 42″ Mill has already attracted the attention of the machine tool supervisors.

The job of boring and facing a crosshead is a natural for a KING Mill — both operations are performed simultaneously. In addition to crossheads, this unit is also used for many other jobs — cylinder heads — valve bushings — packing rings — rod bushings and other locomotive parts within the chucking capacity range.

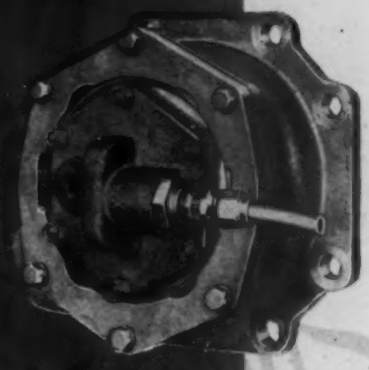
KING Mills have made excellent records in many railroad shops — why not yours? Single column machines, 30″, 36″ and 42″ swing — double column mills from 52″ to 144″ swing. All available with or without side head.

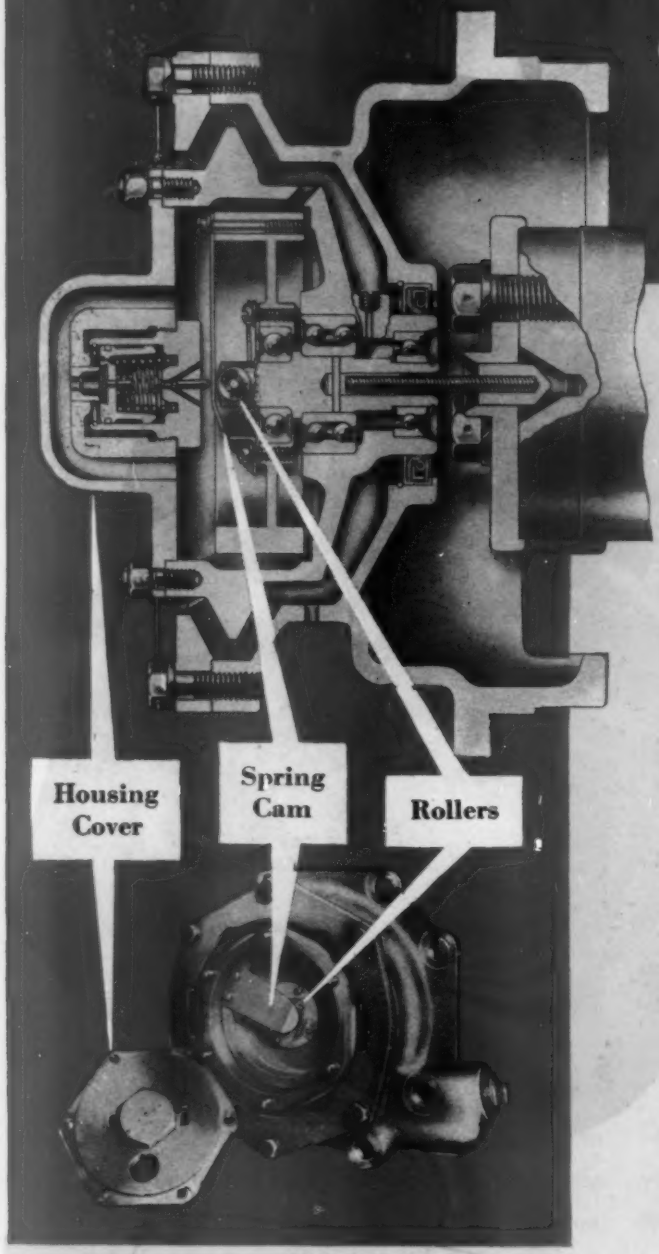
The KING MACHINE TOOL Company

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

CINCINNATI, OHIO

A Look through the *Middle* of the "AP" Decelostat





THE "AP" Decelostat truly rolls with the wheel and registers change in wheel retardation when brakes are applied. If the wheel slips, the high rate of retardation motivates the Decelostat to moderate the braking force and forestall slide.

Sensitivity is obtained with mechanical simplicity. The Decelostat shaft rolls on ball bearings, front and rear; its actuating medium is a simple spring cam. Mechanical design requires few parts—assures the operating reliability that instantly identifies wheel slip and *softens* the brake.

SOFTENS THE BRAKE
WHEN WHEEL SLIP IMPENDS

Westinghouse Air Brake Company

Wilmerding, Pa.

RAILWAY MECHANICAL ENGINEER

(Name Registered, U. S. Patent Office)
With which is incorporated the RAILWAY ELECTRICAL ENGINEER.

Founded in 1832 as the American Rail-Road Journal

Published on the second day of each month by

Simmons-Boardman Publishing Corporation

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JULY, 1945

Volume 119 *No. 7*

Today's Staybolt Job is *tough* but so is

BYERS STAYBOLT IRON

This view inside a firebox shows some of the thousands of staybolts, made from Byers Staybolt Iron, that help to keep this locomotive's availability high, and so help the railroads to continue their miracles of transportation.

During this war period, locomotives have probably handled heavier loads at higher average speeds, and gone further between shoppings, than ever before in history. And it is worthy of note that on an overwhelming majority, the staybolts that helped do the job were wrought iron. As many an old boiler maker will say, there's no substitute for this time-proven material.

Byers Staybolt Iron reinforces the natural advantages of wrought iron with a number of special benefits. The resistance to vibration and shock that's so important in staybolts depends on the combination of silicate slag fibers and high-purity iron body, which gives a structure like that of a stranded wire cable. The tremendous reduction used in producing Byers Staybolt Iron—over 50,000 to 1—gives the best slag distribution.

Every step in manufacture is carried on under close control, so that Byers Staybolt Iron is unusually uniform in analysis, structure and dimension. The material is ductile and malleable which facilitates heading. And it has excellent resistance to corrosion and to high firebox temperatures. Of especial importance to roads with extensive locomotive repair or construction programs is the favorable delivery situation on Byers Staybolt Iron. Not only are we able to take care promptly of the requirements of the military . . . we are also able to fill promptly the needs of domestic railroad users.

Over 75 railroads have utilized Byers Staybolt Iron, which is an excellent index to its service qualities. You can order Byers Staybolt Iron for fabrication in your own shops or specify it when you order from a staybolt manufacturer.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

FORGING BILLETS. The same unusually high quality and uniformity found in Byers Staybolt Iron is duplicated in Byers Forging Billets. They are produced in round, square or rectangular sections, under ASTM-A-73 and AAR-M-307 Specifications.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

Test-Plant Tests of Pennsylvania Duplex Locomotives*

By Ralph P. Johnson†

The type proposed by Baldwin and fitted with poppet valves developed over 6,500 i.hp. with a steam rate of 15.4 lb. – Over 100,000 lb. of evaporation per hr.–Mechanical efficiency high

IN the last ten years the increasing weight and length of passenger trains, combined with a continually rising demand for speed, has focused attention on motive-power design for this exacting type of service. The 4-8-4 type steam locomotive has been quite generally accepted in the United States as the best answer in this field, especially as it can double efficiently in fast-freight service.

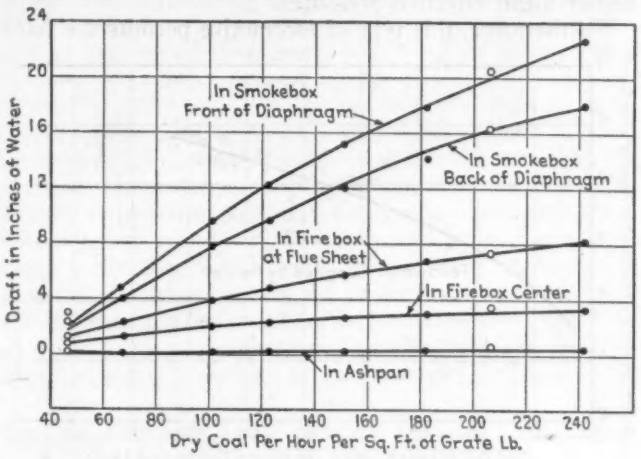


Fig. 1—Draft losses through the boiler

Coincident with the use of the 4-8-4 for fast, heavy service came a breakdown of the old habit of changing locomotives with the varying characteristics of the terrain. The 4-8-4, with its big boiler and high wheels, is at its best possibly over fairly level country, but its weight also enables it to do an effective job in mountainous regions. This resulted in longer and longer locomotive runs until now it is common to run this type of locomotive as much as 1,800 miles at a time. This type of operation makes monthly averages of 20,000 miles fairly common.

Naturally, the more intensive use of power showed

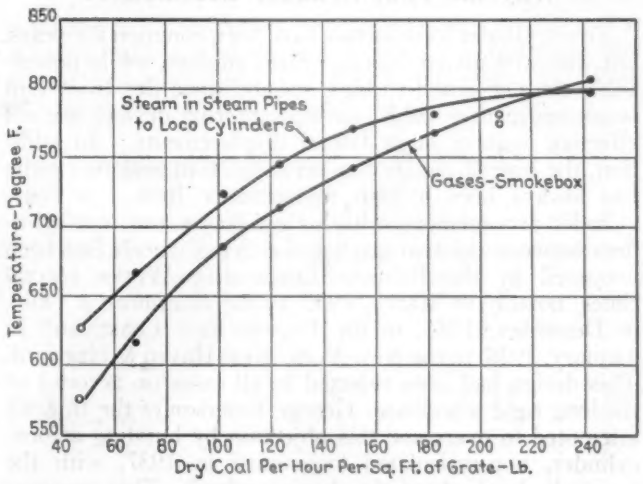
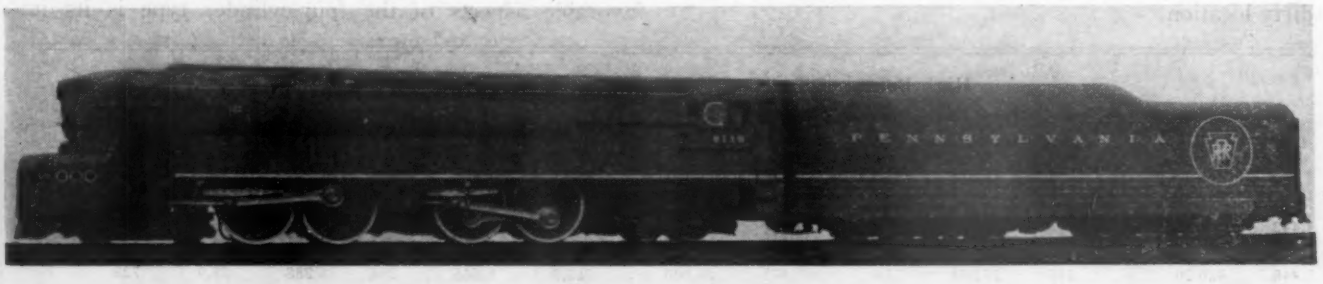


Fig. 2—Steam and smokebox temperatures



The Pennsylvania T-1 locomotive

* From a paper presented before the May 17 meeting of the New York Railroad Club.

† Chief engineer, Baldwin Locomotive Works.

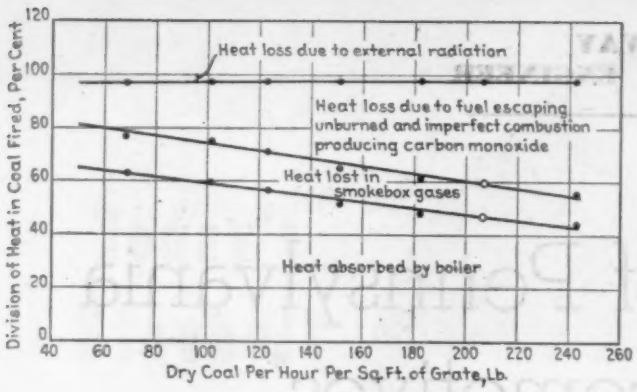


Fig. 3—Heat balance

the necessity for high-class maintenance and justified the use of such devices as roller bearings not only on axles but on main and connecting rods as well. Designers began to give intensive thought to means of increasing availability and lowering maintenance time and costs.

One of the means for accomplishing this which suggested itself was the lowering of the piston thrust on crank pins by using four smaller cylinders in place of the two cylinders of conventional design. Many of the modern 4-8-4 type locomotives with boiler pressures around 275 lb. per sq. in. have piston thrusts of 160,000 lb. and one fleet with 300 lb. per sq. in. boiler pressure has 185,000 lb. Such thrusts require large crank-pin bearings, but the lengths of crank pins are restricted by clearances and the diameters by available space in the wheel center. With four cylinders the piston thrust can be cut in half and, even with 300 lb. per sq. in. boiler pressures, can be brought down to 90,000 lb. This smaller load makes possible smaller bearings at the back end of the main rod and eliminates heavy moving parts.

Why the Four-Cylinder Locomotive?

Four-cylinder locomotives have been common for years, but with articulated frames. Such engines, while powerful, were not suited to high speeds, since the front unit is not sufficiently stable; spring-centering devices are not effective against slight lateral displacements. In addition, the hinged connection between front and rear units has always been a high maintenance item. A four-cylinder arrangement, with a rigid frame and rear cylinders between the two groups of driving wheels had been proposed by the Baldwin Locomotive Works several times, notably in March, 1932, to the Baltimore & Ohio, in December, 1935, to the Florida East Coast, and in January, 1936, to the New York, New Haven & Hartford. This design had been rejected in all cases on account of the long rigid wheelbase. George Emerson of the B. & O. attempted to overcome this objection by building a four-cylinder, non-articulated locomotive in 1937, with the rear cylinder back of the driving wheel. This arrangement, however, is undesirable for various reasons:

(1) The cylinder, guides, and crosshead are in a very dirty location.

(2) The location is cramped and inaccessible and it is difficult to get steam and exhaust pipes into the available space.

(3) The rear unit is running "backward" in forward motion, which means that the crosshead thrust is downward and multiple-bearing guides have to carry this additional load entirely on the ledges.

(4) A very short main rod is required unless the cylinder is placed far under the firebox.

(5) Very little is gained in overall length of locomotive as saving in rigid wheel base is cancelled by longer overhang due to moving the grate further to the rear to avoid contraction of the ash pan by the rear cylinder saddle.

For the above reasons we prefer the four-cylinder locomotive of our own design.

In addition to the lower piston thrusts of the four-cylinder type, the arrangement allows the use of a shorter stroke, as less strength is required for axles and crank pins and the smaller diameters allow them to be placed closer together in the wheel centers. This, in turn, results in lower piston speeds. As indicator-card areas are governed by revolutions per minute and piston speeds, the lower piston speeds give a bigger card area and, hence, higher mean effective pressures.

Furthermore, this type of locomotive permits the most

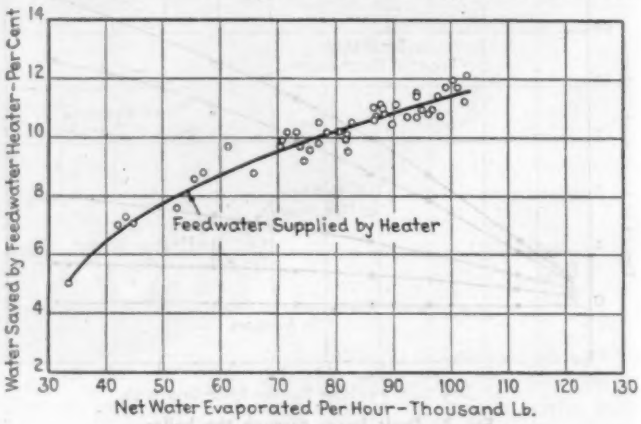


Fig. 4—Saving effected by the feedwater heater

simple driving-rod arrangement with the best possible conditions at the main side-rod connection which need only be large enough to transmit the load to one pair of drivers as contrasted with the large side-rod connection necessary on a 4-8-4 type locomotive to transmit the load to three pairs of drivers.

Again, it is a fundamental fact that as the number of coupled drivers increases, so also does machine friction. Splitting up the drivers of a 4-8-4 type locomotive into two groups, as in the 4-4-4-4 type, or of a 2-10-4 type into a 4-4-6-4 type, reduces the machine friction, thus giving higher drawbar pull, especially at high speeds.

When Baldwin first started work on four-cylinder designs, a commercial poppet-valve gear was not available, but even without the poppet valve one of the most favorable aspects of the four-cylinder type is its im-

High Points of Tests of Pennsylvania T-1 Class Locomotives

Test No.	Test designation	Speed, m.p.h.	T.F. from i.hp.	Steam rate, lb.	Total evaporation, lb.	Total coal consumption, lb.	Firing rate, lb. per sq. ft. per hr.	I.hp.	Pressures, lb.			Steam temperature, deg. F.	Superheat, deg. F.
									Boiler	Steam pipe	Exhaust passage		
1,473	160-50-F	38	47,743	16.3	80,620	13,703	150.1	4,838	296	292	18.1	741	322
1,427	240-40	57	40,094	15.6	96,574	19,340	211.8	6,105	297	292	19.3	738	319
1,406	280-30	67	34,004	15.4	94,236	16,970	185.9	6,021	293	281	15.3	738	320
1,442	320-35	76	31,993	15.3	101,583	22,629	247.8	6,484	294	286	29.4	799	381
1,414	360-25	86	28,737	15.4	102,816	18,370	201.2	6,552	295	287	24.2	757	339
1,444	400-20	95	25,832	14.7	97,949	19,536	214.0	6,544	295	288	25.0	781	363
1,448	420-20	100	25,048	15.6	105,475	24,000	262.9	6,666	296	288	25.9	728	310

proved ability to handle steam through four piston valves, rather than two. A 4-8-4 type locomotive with a 27-in. cylinder and a 12-in. piston valve is definitely crippled at speeds by the inability of the valve to handle steam efficiently. In the case of an equivalent 4-4-4-4 type we would have four 20-in. diameter cylinders and four 12-in. diameter piston valves, which is equivalent to a 24-in. piston valve with a 28-in. cylinder, as the area of two 20-in. cylinders is the same as that of a 28-in. cylinder. Thus, the ratio of valve diameter to cylinder diameter is increased from 44 per cent on the 4-8-4 type to 86 per cent on the 4-4-4-4 type, with a consequent ability to handle steam more efficiently.

All of these considerations prompted the Baldwin Locomotive Works to place a stock order to design and build a 4-4-4-4 type locomotive for demonstration purposes in high-speed heavy passenger service, and this decision was made in October, 1939. However, before we could build this demonstrator, a great railroad company stepped in and gave us an order.

The Pennsylvania T-1 Class

The Pennsylvania in 1937, in search for better steam power, had formed an advisory committee composed of the chief engineers of the three largest locomotive builders, and as a result of their work built at Altoona the four-cylinder locomotive known as the S-1. This was exhibited in 1939 and 1940 at the World's Fair in New York. After the Fair this locomotive was placed in service, but was necessarily restricted to certain territories on account of its large size. Nevertheless, the Pennsylvania's experience with this locomotive convinced them that the four-cylinder rigid-frame type had many advantages. Further, they were forced to a considerable amount of double-heading of passenger trains, so when the Baldwin Locomotive Works submitted their specification for a four-cylinder type, smaller than the S-1 but more powerful than any other passenger locomotive yet

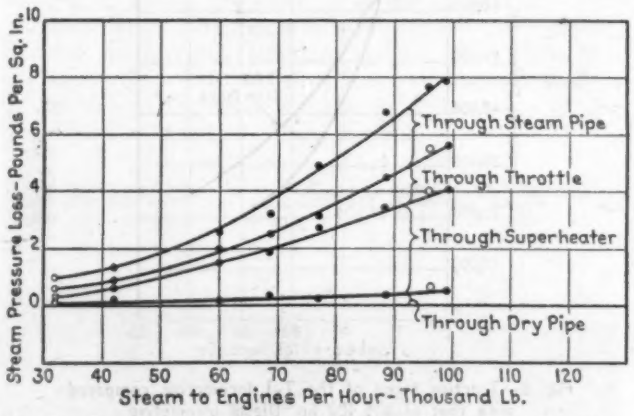


Fig. 5—Steam pressure losses from the boiler to the cylinders

designed, the Pennsylvania promptly placed an order for two on July 30, 1940. They gave the class number "T-1" to these two locomotives and, thus, became the pioneer railroad in the use of this new engine.

The locomotive was designed to haul a trailing load of 880 tons (eleven 80-ton passenger cars) at 100 miles per hour on level, tangent track, and to traverse 15-deg. curves at a maximum speed of 15 m.p.h. It was expected to evaporate a maximum of 85,000 lb. of water. When first planned, piston valves were considered, but before being built tests by the Pennsylvania with a poppet-valve gear on one of their K-4s, a 4-6-2 type locomotive, indicated at least a 20 per cent improvement in efficiency.*

As the proposed locomotive was intended to operate at speeds of 100 m.p.h. and over, the Baldwin Locomotive Works recommended that the two locomotives, to be known as the T-1 class, be equipped with this type of gear. To this the Pennsylvania acceded.†

The first of these locomotives was delivered to the railroad on April 22, 1942, and the second on May 21, 1942. The front ends required some adjustment for proper steaming and the locomotives were then placed in fast-passenger service between Harrisburg and Chicago.

Locomotive No. 6110 made its first through test run

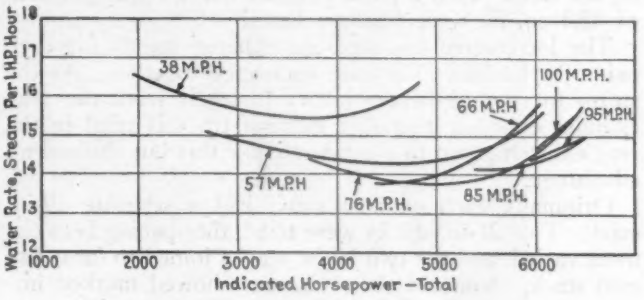


Fig. 6—Steam per indicated horsepower hour

from Harrisburg, Pa., to Chicago with a train of 14 coaches weighing 1,000 tons. It had no trouble in bettering the normal schedule, leaving Crestline, Ohio, 15 min. late and arriving at Fort Wayne, Ind., 5 min. ahead of schedule. It left Fort Wayne 3 min. late and arrived in Chicago 10 min. ahead of schedule. From Crestline to Chicago the speed was consistently around 100 m.p.h.

On another test trip, locomotive No. 6111, hauling 16 cars, covered 69 miles on the Fort Wayne division at an average speed of 102 miles per hour.

These locomotives proved themselves so powerful that they were reserved for heavy passenger trains which otherwise would require double heading.

In April, 1944, locomotive No. 6110, having accumulated about 120,000 miles in road service, was sent to the Altoona test plant for a complete test. The test plant was rebuilt to accommodate her and a test program devised to explore her capabilities thoroughly.

Steam Passages and Gas Areas

In order to keep the pressure drop from the boiler to the cylinders as low as possible, the steam passages were made large. They are shown in the table.

Areas of Steam Passages

	Sq. In.
Dry pipe	78.9
Superheater elements	137.6
Throttle	101.7
Steam pipe (each)	63.6

The resistance of the flues to the passage of the gases of combustion depends upon the area of the openings through the flues and the hydraulic depth of the flues (hydraulic depth is the cross-sectional area of the flue through which the gases flow, divided by the gas-swept perimeter). As this resistance is an important factor in the capacity of the boiler, these dimensions are of interest.

* For road tests of Pennsylvania locomotive No. 5399 equipped with the Franklin system of steam distribution see the April, 1941, *Railway Mechanical Engineer*, page 125. For the results of test-plant tests, see the May, 1941, *Railway Mechanical Engineer*, page 169.

† For a description of the Pennsylvania T-1 locomotive see the January, 1943, *Railway Mechanical Engineer*, page 1.

Gas-Flow Proportions of the Boiler

Area through all flues, sq. ft.	10.61
Grate area, sq. ft.	91.3
Ratio—grate area to flue openings, sq. ft.	8.6
Hydraulic depth of all flues, in.	4.27

As delivered, the railroad felt that steaming required more careful attention to firing than was desirable and, therefore, experimented with various stacks, nozzle diameters, diaphragm and table-plate arrangements.

All nozzles were of the 5- or 6-point star type and their area was changed by varying the width of the outer edge of the slots. Two 5-point exhaust nozzles with an area of 43.1 sq. in. were finally selected.

The locomotive has separate exhaust stands for each pair of cylinders. They are connected together. As the steam for the feedwater heater is taken from the rear cylinder exhaust, a smaller exhaust tip was tried in the rear exhaust stand to compensate for this but showed no advantage.

Originally each exhaust stand had a separate 19-in. stack. Two 21-in. stacks were tried, the spacing between them varied, and the two 19-in. stacks joined to form one oval stack. None of these changes showed marked improvement, but the oval stack was finally adopted as it is an easier casting to make and weighs less. A 6-in. radius on the bottom flare gave the gases an easier entrance into the lift pipe than the original 1¼-in. radius.

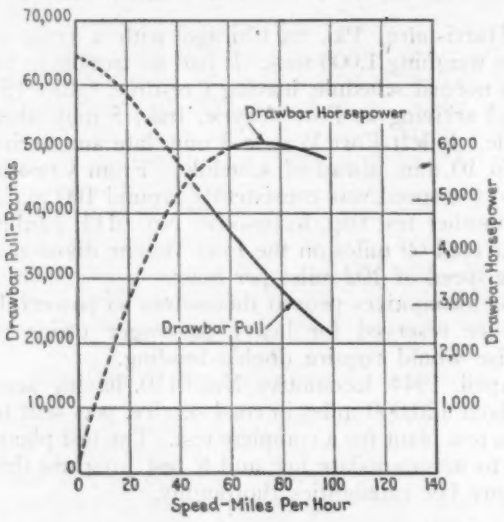


Fig. 7—Drawbar pull and drawbar horsepower corrected for a water rate of 100,000 lb. of steam per hour

The "cinder-buster" type of front end in addition to diaphragm and table plate of the conventional type, has a vertical baffle at the front of the table plate with an open space in front of the baffle between it and a sheet of netting at the extreme front of the smokebox.

Fig. 1 shows the drafts taken at different locations to show the loss through the several parts of the boiler. It will be noted that at normal rates of firing—i. e., 150 lb. per sq. ft. of grate area—the draft is 15 in. of water and that the greatest draft required is through the flues at all rates of firing.

The table-type grate bars are 9¾ in. wide with 136 $1\frac{1}{16}$ in. square holes on a side, giving an area with the openings between bars of 14.93 sq. ft., or 16.4 per cent of the total grate area for air admission.

The Test-Plant Results

Tests were made at speeds of 38, 57, 66, 76, 85, 95, and 100 m.p.h. and at various cut-offs from 10 to 50 per cent, with full throttle, and there were various other miscellaneous tests run for special purposes.

Coal used was a high-volatile, run-of-mine, Westmoreland County, with all slack under ¾ in. screened out. Its calorific value was 14,123 B.t.u. and ash content 7.58 per cent.

The only specific requirement given the railroad when placing the order for these two locomotives was that they should be capable of hauling a train of eleven 80-ton passenger cars at 100 m.p.h. on level tangent track. Based on the Davis formula for train resistance, this requires a drawbar pull of 11,200 lb. In service the locomotives have considerably exceeded this requirement, having hauled 16 cars at an average speed of 100 m.p.h. over typical stretches of road. Test-plant records show such performance to be easily possible, a cylinder tractive force exceeding 25,000 lb. having been obtained at 420 r.p.m. (100 m.p.h.), which is considerably more than required to haul the locomotive and a 16-car train.

The calculated evaporation, based upon the Baldwin 80-lb. rule, including feedwater heater, is 82,000 lb. Actually, this has been greatly exceeded, a maximum of 105,475 lb. having been obtained on the test plant. Road performance also shows that the calculated evaporation is being consistently exceeded in service, which can be credited to the large furnace volume which supports a high rate of combustion.

Boiler Performance

Steam temperatures were taken in the header to the front and rear cylinders where it joins the steam pipe leading from the superheater header. Fig. 2 shows these temperatures at various rates of firing, compared with the temperatures of the smokebox gases. The high degree of superheat obtained at even relatively low rates of evaporation is outstanding. This is interesting as it is being obtained with a single-loop Type A superheater.

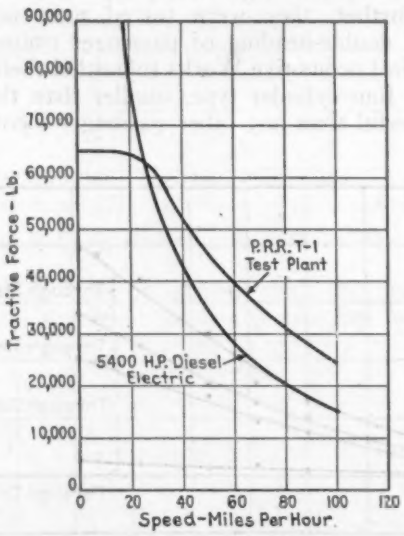


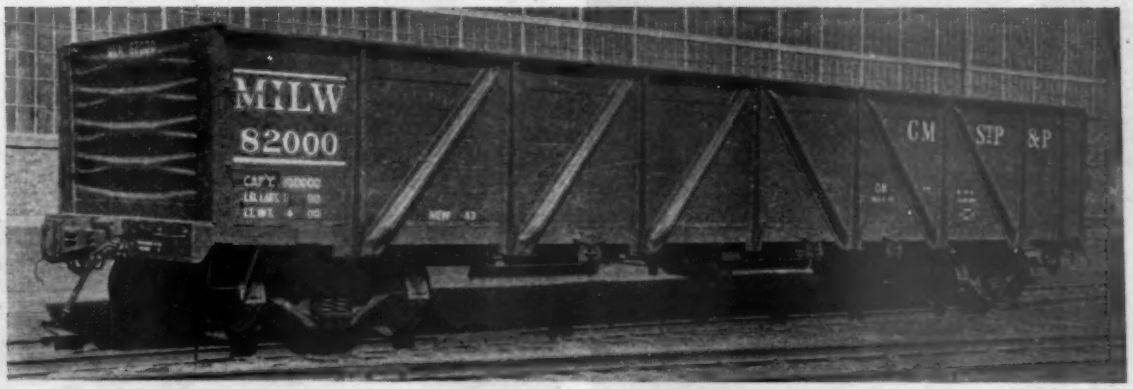
Fig. 8—Tractive force of the T-1 locomotive compared with that of a 5,400-hp. Diesel locomotive

The maximum capacity of the boiler was found in a test at a speed of 100 miles per hour, full-throttle, 20 per cent cut-off, and a firing rate of 252.2 lb. of dry coal per sq. ft. of grate area per hour. The evaporation in this test was 105,475 lb. of water per hour.

The efficiency of the boiler and furnace at various rates of firing ranges from 65.5 per cent when burning 50 lb. of dry coal per sq. ft. of grate area to 43 per cent when

(*Continued on page 292*)

Fabrication of Gondolas*



Composite gondola built at Milwaukee shops

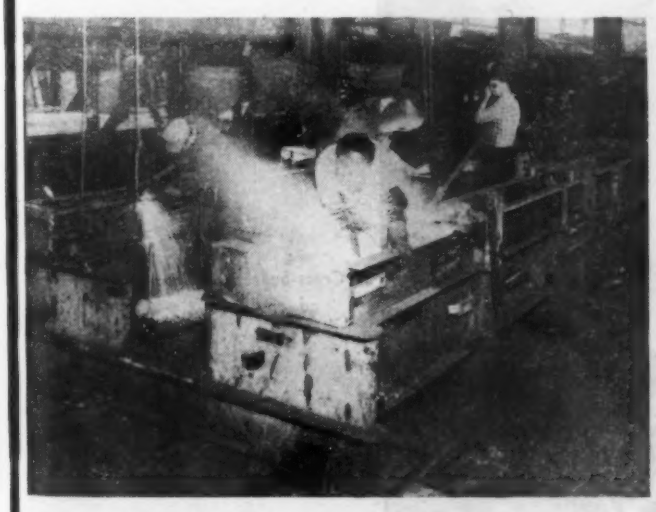
50-ton all-purpose composite gons are built by welding at the Milwaukee shops — Production is eight cars a day

THE Chicago, Milwaukee, St. Paul & Pacific has pioneered in the development of all-welded cars, both freight and passenger, and in the last ten years has designed and constructed at its Milwaukee, Wis., shops about 250 lightweight passenger cars, and over 12,000 freight cars of various types.

Of the recent groups of cars constructed, 735 composite gondola cars were designed to carry all manner of loads—bulk sand, gravel, coal, pipe, steel shapes, plates, etc. Classified as all-purpose utility gondola cars, they average around 44,800 lb. and were turned out at the rate of eight cars a day, or one each hour in a car shop arranged to stress flexibility of production layout.

Frames were constructed almost entirely by welding, following an accepted standard design. Car sides and floor were of wood. Utility features incorporated in the car design included six hinged drop doors in the floor, operated manually from the side.

* Information presented in this article was compiled by representatives of the Milwaukee mechanical department and of the Air Reduction Sales Company which supplied all photographs except that of the finished car.



Welding of center sills supported on jig positioners

This accomplishment was not without precedent in the Milwaukee shop, where ever since 1934 freight cars have been constructed by position-production methods employing erection lines supplied by subassembly flow lines. Year by year new economies—savings in labor and materials—have been realized through increasingly efficient use of the techniques of all-welded construction.

High strength, durability and weight saving are primary objectives of Milwaukee construction methods. It was in this shop that the first lightweight passenger car on the Milwaukee was constructed in 1934. This car, 30,000 lb. lighter than its predecessors, has proved many times over in ten years of continuous service to be equally successful from the standpoints of both operation and maintenance. During the intervening years great improvements were made in welding procedures, designs, and construction of jigs for both passenger and freight cars. As a result, further weight savings were achieved along with higher utility and facility of construction, all without any sacrifice of necessary strength in the finished car. An important part of the saving in weight, it should be mentioned, is achieved through the use of low-alloy steels in place of plain open-hearth steels.

As an illustration of the possibility of savings in weight reduction, the 50-ton, 40-ft. 6-in. and the 50-ton, 50-ft. 6-in. box cars, built at this shop, netted a weight saving over the conventional car up to 4½ tons a car, and at the same time produced a box car that was wider and higher and had greater cubic capacity than any other car built in the country within A. A. R. clearance limitations. Statistical data has been developed indicating that for each ton of weight reduction made in a freight car, a minimum saving of $12 per car per year

Side-frame assembly—Note the shop-made hold-down clamps on this jig

can be effected. For passenger cars which make about ten times the yearly mileage of a freight car, the savings are calculated at $120 per car per year for each ton of weight reduction.

With the all-welded type of construction, fitting-up of parts to the various assemblies requires simple jigging and, therefore, only a minimum of mechanical skill, an important and somewhat rare commodity. The same applies largely in the fabrication of parts, inasmuch as this fabrication consists for the most part merely in using steel structural plates, sheets, bars, etc., purchased to the most economical mill tolerance and then sheared or cut with an oxy-acetylene machine.

Plate up to 5/8 in. is used and electrodes up to 5/16 in. in diameter. At junctures of important stress points, deep fillet and vertical welding are employed.

Selection of arc welding equipment has kept pace in the shop with developments such as the trend toward larger electrodes and higher welding heats. Also, wherever possible, simple positioning devices have been installed to insure the best work from operators whose ability in flat or downhand welding may not be matched by proficiency in welding in the horizontal, vertical and overhead positions. For the most part, the shop is equipped with 300-amp. welders which are considered best for this work, although a few smaller and a few larger capacity machines are also used. The 3/16-in. diameter electrode is the size most commonly used.

Two Erection Lines

The shop production plan involves two erection lines with subassemblies feeding in. The cars move along the line in scheduled progression from one specialized erection position to another. Adequate time is allowed for the orderly distribution of material and men to each position.

Drop ends are assembled on a table-size jig—Ends drop inward from hinges at the bottom

The erection lines are two parallel stretches of standard gauge track. Beside them run other supplementary lines inter-connected by switches strategically placed to insure steady production flow over the entire network. After initial fabrication work is completed, prefabricated sections are stacked at appropriate positions alongside the first erection line. Here the bulk of the actual heavy construction work is completed before the car rolls onto the next erection line to receive wooden flooring and undergo various finishing operations.

Cross-bearers tacked and welded on rotating positioner

Underframe assembly is welded on the trucks at the head of the assembly line

Construction of the Cars

As shown in an illustration, center sills are arc welded on two sturdy jig-positioners close beside the erection line. At this stage they are welded on only one side. Then holes are cut with a hand torch in A.A.R. Z-26 center-sill sections 12⅞ in. deep, and the sections are assembled with center filler, striker, draft gears, air cylinder, lever guides, slack adjusters and couplers.

Assembly of center fillers is facilitated by use of a positioner and alignment frame which allows easy and unlimited repositioning of the work so that the operator may have ready access to all weld areas and may do the entire job by downhand welding. Before the war, cast center fillers and strikers were used, but with the increased scarcity of cast steel, a welded substitute which has proved satisfactory was designed. Principally built up from plate sections, it still includes one small cast portion and thus stands out as an interesting example of the potentialities of combined cast and welded fabrication.

Cross bearers are tacked and finish-welded on a combination jig and positioner consisting mainly of a long trunion-mounted horizontal shaft. The work is repositioned by rotation of the shaft while the side, top and bottom plates are held in correct alignment by saddle and wedge jigging devices. Bolster assemblies are welded on a rotating shaft positioner very similar to this.

Fabricated car parts are stacked on sturdy low-slung trucks and wheeled to positions on the erection line. Lighter subassemblies and additional material are moved on lighter trucks like those in the background of one of the views.

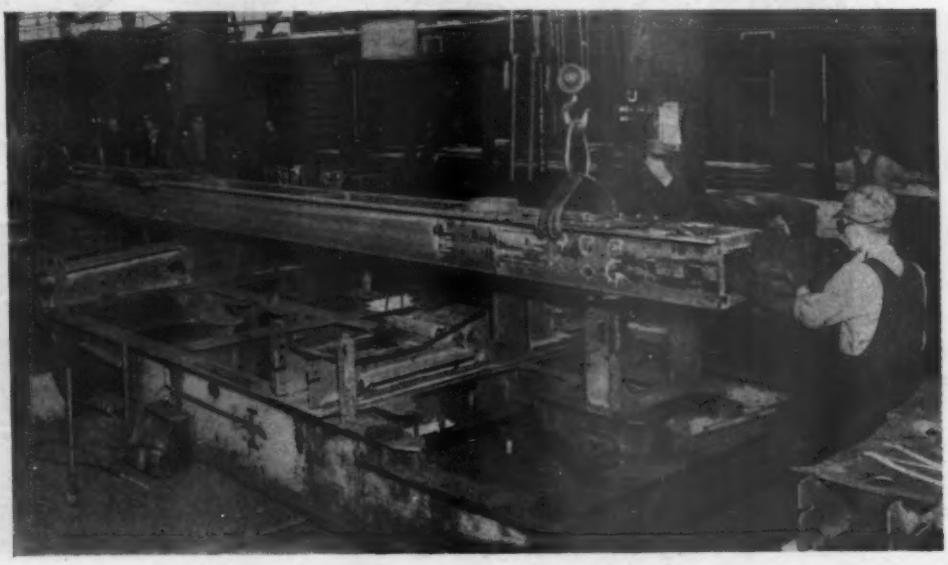
Drop doors are fabricated by welding on special positioners. Included in their assembly are a door base plate, Z-iron stiffeners and a T-iron catch to engage with the door locks. The T-irons are produced by slitting at the steel mill or in the shop by cutting with an oxy-acetylene machine torch.

Provision for Contraction

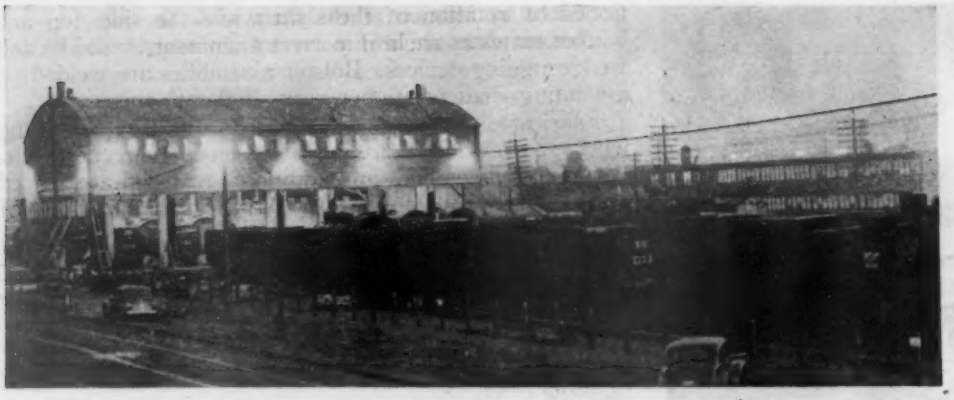
No special effort is made to prevent distortion in many of the subassemblies. In some instances jigs are designed with the deliberate intention of introducing a slight camber into the assembly. This camber acts as compensation for subsequent contraction of the welds, thereby eliminating distortion in the finished part; however, in welding heavy material this is not necessary.

(*Continued on page 291*)

Fabricated car parts are carried to erection line on hand trucks—On the truck in the foreground are bolsters and cross-bearers

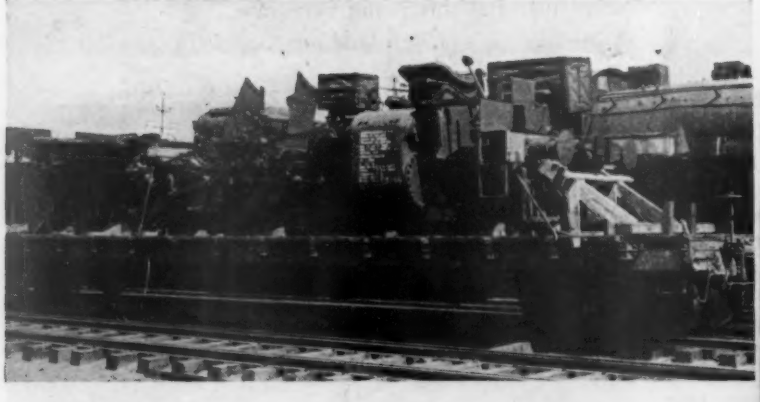


Uprights on underframe hold parts of first major assembly in line for welding

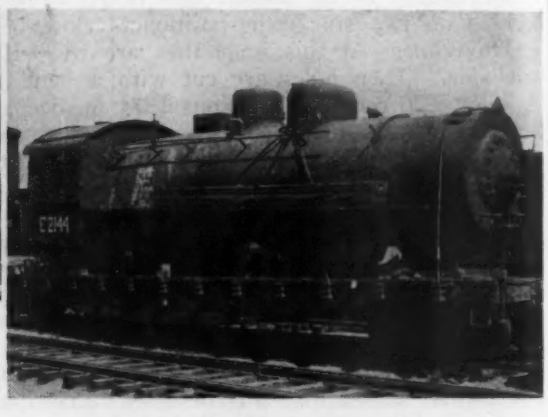


The locomotive shop and the yard for the storage of assembled locomotives

Assembling Russian Locomotives



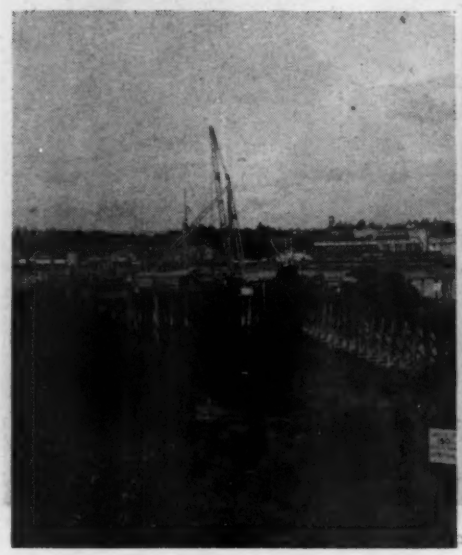
The boiler section as received from the builder's plant



Above: How the frames and running gear of the Russian 2-10-2 locomotives are received from the builders — Below: The shop interior

THE District Transportation Office of the U. S. Army operates this plant at Portland, Ore., for assembling Russian 2-10-0 locomotives preparatory to loading them on shipboard in the Columbia River. The locomotives are received from the American Locomotive Company and the Baldwin Locomotive Works. All photographs are from the U. S. Army Signal Corps except as otherwise noted.

Top: A completely assembled locomotive moving out of the shop to the transfer table—Center: From the transfer table the locomotives and tenders are moved into the storage yard—Below: The trestle leading from the yard to the loading dock—Right: This locomotive will soon be secured in the hold



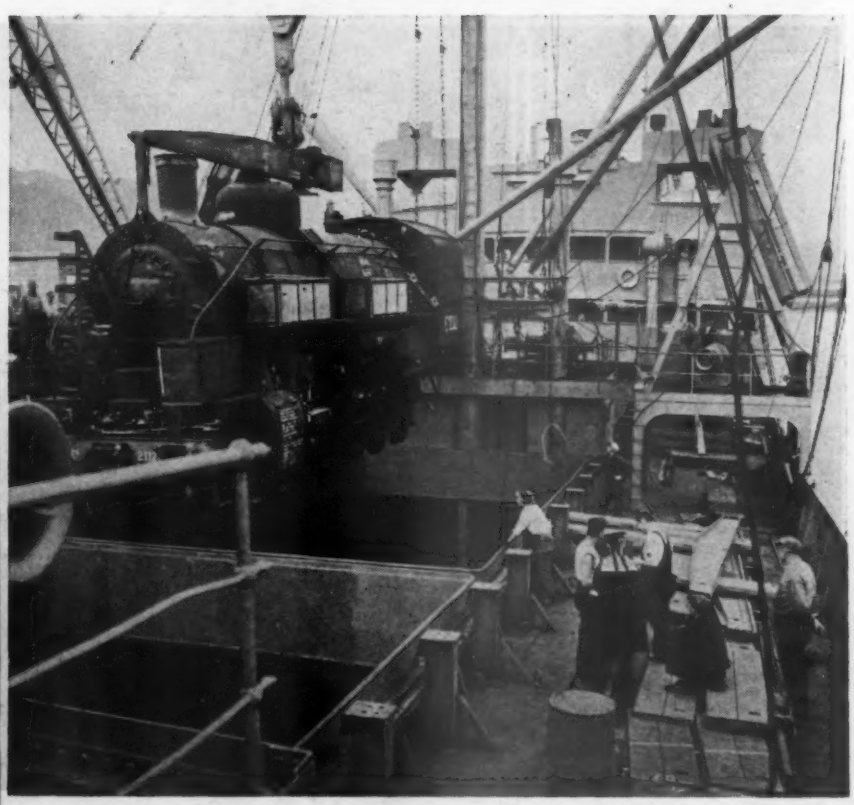


Photo courtesy of Willamette Iron & Steel Corp.

Use of Metallic Arc Welding in

Fabricating Pressure Vessels*

By Charles M. Scudder† and John J. Chyle†

Many steps in building of unfired vessels by welding applicable to locomotive boilers – Good engineering and shop practice essential

THE development of the welding process, with respect to the construction of pressure vessels has advanced to such a state that the great majority of all pressure vessels built today are of welded construction. This development of the welding process originated with the building of oil refinery vessels. The first metallic arc welded pressure vessel for the oil industry was fabricated by the writers' company in 1925.

By the beginning of 1925, the oil industry was becoming very much concerned over the safety of its pressure vessels. Riveted and forge-welded vessels were proving absolutely inadequate for such service. Two major accidents at this time, involving considerable loss of life and property emphasized the need for drastic changes in pressure-vessel fabrication. The impossibility of keeping riveted vessels tight under the conditions of wide temperature and pressure fluctuation imposed, created a fire hazard of a most serious nature. The process of forge welding was not developed to a point where consistently high quality forge welds could be obtained. Adequate inspection methods were not available at that time to detect inferior workmanship.

Our company was a pioneer in the development of coated electrodes which produced ductile weld metal suitable for pressure-vessel welding. The coated electrode was initiated in 1917, and by 1925 the process of producing sound and ductile welds had been proved. Based upon this development the first metallic arc-welded oil cracking still was shipped to the Texas Company in July 1925.

Although the problem of producing high-strength, ductile welds had been solved, it was soon realized that certain elements of construction such as heads, manways, nozzle connections, etc., were improperly designed. This fact was emphasized through the subjecting of all-welded vessels to much higher pressure tests than had been possible with riveted vessels. To solve these problems adequately, full-sized vessels were tested to destruction and various measures taken to determine the behavior of the critical parts and points where modification or reinforcement appeared necessary. Economic and efficient design demands that all parts of a vessel have approximately the

* A paper prepared for the 1944 proceedings of the Master Boiler Makers' Association.

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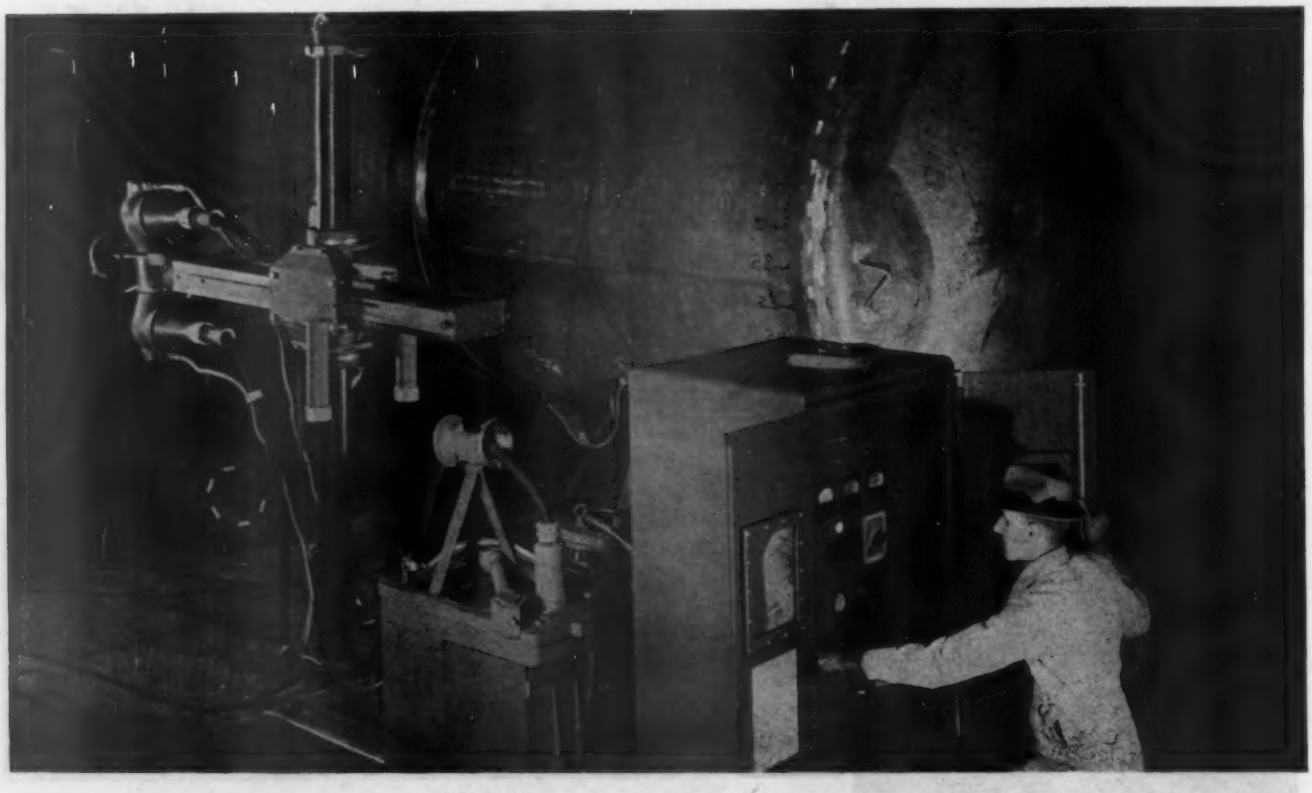
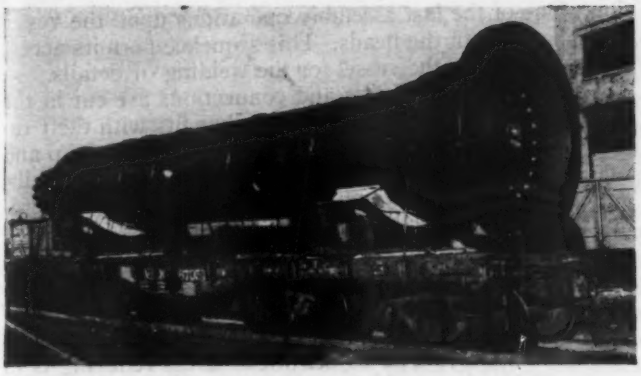


Welded seams are X-rayed to disclose defects



This large high-pressure accumulator was fabricated by welding

same factor of safety. In order to obtain the information necessary to produce such a design, some 23 full-sized vessels were tested to destruction by our company. As a result, present-day all-welded designs are well balanced as to the factor of safety of the various parts.

For a great many years all types of pressure vessels have been the subject of regulations concerning their construction to insure safety. One of the early groups considering such matters was the A. S. M. E. Boiler Code Committee which wrote a code covering riveted and other contemporaneous types of construction as applied to steam boilers. The all-welded pressure vessel fell outside of any code regulations at the time of its inception and remained outside of the codes for a considerable period due to the hesitancy of the code bodies to approve metallic arc welding. Other groups having to do with the public acceptance of pressure vessels, such as the Interstate Commerce Commission and some of the insurance companies, were also very slow in accepting metallic arc welded construction and in recognizing its advantages.

As the A. S. M. E. Boiler Code was primarily written for steam boilers, its early regulations did not adequately cover refinery vessels. Therefore, the American Petroleum Institute in co-operation with the A. S. M. E. developed a code designed primarily to apply to such vessels and which is now known as the A. P. I.-A. S. M. E. Code for Unfired Pressure Vessels. At the present time, the two codes call for a factor of safety of four, based upon the minimum tensile strength of the steel. Welded joints are assigned efficiencies varying from 80 to 95 per cent for fully penetrating butt welds. A definite procedure is outlined for qualifying welders and for the procedure to be used in pressure-vessel production. These two qualification requirements constitute very important steps toward insuring reliable welds.

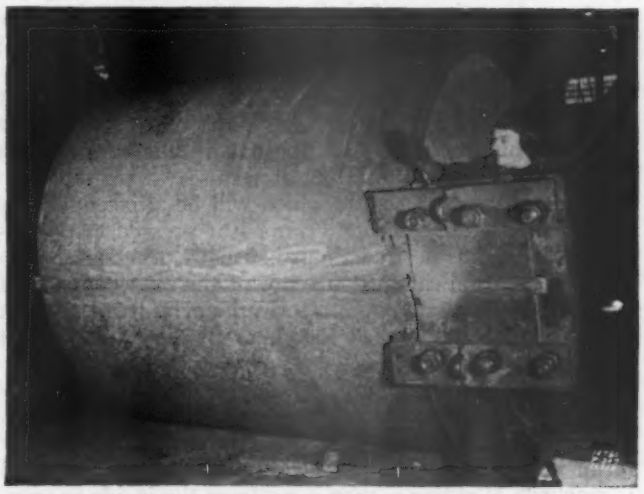
Making High-Quality Welds

The production of a high quality weld depends upon many factors, the principal ones being: the electrodes; skill of the welding operators; the plate material; and the welding procedure.

The development of electrodes today has been such that a great variety of different types are available for specific applications. It is necessary to select the electrode which will give the desired physical and chemical properties to the finished weld. The electrode should also be selected upon the basis of the type of welding to be done, such as downhand, horizontal, vertical, etc. The American Welding Society in conjunction with the American Society for Testing Materials has issued specifications covering the various types of electrodes accepted today.

The high quality of welding required on pressure vessels makes it mandatory that only experienced operators be employed. The operator should be qualified under the operator qualification tests which are specified by the A. S. M. E. or other codes. It is also important that his past experience be sufficient to enable him to correct unusual conditions encountered during welding operations. For important work, we must depend upon the welding operator to report pecularities and irregularities which an inexperienced operator might overlook, attributing any difficulty encountered to his own inexperience. Where automatic welding is used, it is also necessary to have an experienced and qualified operator in charge.

The specification for the steel plate to be used should be chosen with due regard for weldability as well as physical and chemical adaptability for the job to be done. The weldability of steel plate is dependent primarily upon its chemistry and cleanliness. Under present day conditions, the steel plate may contain excessive residual elements due to the character of the scrap used in its production which might have a marked effect upon the weldability of the steel. For high-strength steels, it is necessary to employ preheating for the welding. The effect of dirty or laminated steel will be to produce defects in the weld metal. These defects, in some cases, can be detected by X-ray examination. If the amount of defects encountered is excessive, a great deal of repairing will be necessary.



Weld test plate attached to shell

Steels are normally purchased under one of the A. S. T. M. specifications.

The welding procedure represents the best judgment of those in charge as applied to a particular welding problem and should be specified by a welding engineer. The welding procedure will specify the type of electrode, the diameter, the welding current, the degree of preheat, the design of the welding groove, and the welding technique to be employed. The welding engineer will also specify the amount and character of peening, the type of welding current, whether a.c. or d.c., and also the heat treatment after welding.

The A. S. M. E. Code requires that the welding procedure be qualified by making a test plate with the proper welding procedure and subjecting the test plate to certain tests. Additional information on the procedure is obtained by the testing of the test plate or plates made in connection with the construction of the vessel. Any deviation in manufacturing procedure requires a new procedure qualification test to confirm its adequacy.

The fabrication of high-pressure vessels of welded construction is similar, regardless of whether it is intended for the oil industry, for the production of high-pressure steam, or for chemical or other purposes. Vessels for oil-refinery service cover a wide range of overall dimen-

sions and wall thicknesses. They may be designed for very high- or low-temperature conditions or for severe temperature cycles. Lengths of 150 ft. or more, diameters in excess of 40 ft. or wall thicknesses of over 4 in. are not uncommon. Temperatures may range as high as 1,000 deg. F. for certain services and pressures of 750 lb. per sq. in. are common.

For accumulators and vessels connected with synthetic ammonia plants, pressures of 5,000 lb. per sq. in. are in continuous use. For these last two types of vessels, the multi-layer construction is frequently employed. There is no reason why welded vessels should not be used for pressures considerably in excess of 5,000 lb. per sq. in. if properly designed.

Manufacture of a Pressure Vessel

Many towers for oil refineries are in the neighborhood of 70 ft. long, 8 ft. in diameter with a wall thickness of 1¼ in. The following outline covers the manufacture of such a vessel, the steps listed being the same as would be involved in the production of practically any solid-wall vessel by metallic arc welding.

Steel plates are purchased to some standard specification, such as A. S. T. M. A-70-39. The plates are inspected at the mill and physical and chemical tests are made to insure conformance to the specifications. The first shop operation upon the plates is to plane or scarf the edges to give the desired groove contour for welding. Gas cutting of scarfs is also employed on thin plates or for special automatic welding. Four sides are usually scarfed while the plate is in the flat to take care of both longitudinal and circumferential seams.

The two ends of a plate which will be adjacent to the longitudinal seam are then crimped or pressed to the approximate radius desired. This is usually necessary as the rolling operation cannot take care of the extreme ends of the plate. It is next rolled to form the cylindrical section, and the edges are tacked together. The section is then ready for welding.

For manual metallic arc welding in which a U-groove seam is used, the welding is generally performed from the outside first. After this weld is completed, the interior lip edges are chipped away until sound weld metal is reached. Welding is then done from the inside to completion. All details of the welding of longitudinal seams must conform to the procedure which was set up by the welding engineer. Test plates are attached to the shell so that the test plate weld is a continuation of the longitudinal seam. The checking of the procedure by the testing of these plates represents an essential control as provided by the Codes. The number of such plates is governed by the total length of seam welded. Subsequent to the completion of the weld, the shell is re-rolled to give it a uniform radius. In the case of thick plates, both the rolling and re-rolling must be done with the plates heated.

Heads for pressure vessels such as are described here, are generally of the semi-elliptical type in which the head is of about the same thickness as the shell and is designed for the same working stresses. Such heads are pressed, spun, flanged or forged depending upon the material, diameter and thickness. The proper scarf is machined upon the head after it has been formed. Openings in the head are usually gas cut or machined out with possible subsequent grinding to clean the scarf thoroughly. Manways, nozzles, etc., are now welded in place in the heads with the appropriate reinforcing collars.

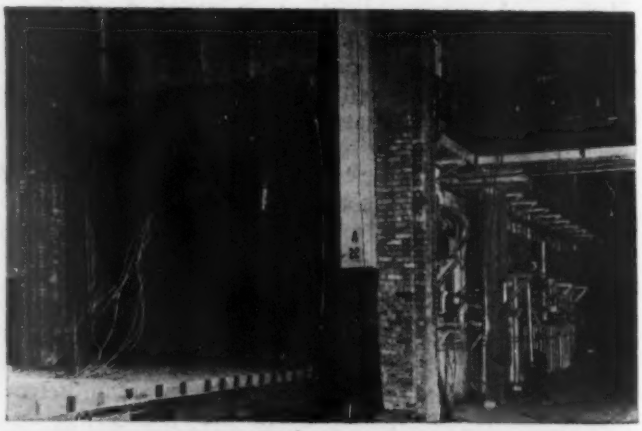
The vessel is assembled by joining the individual shell sections together, utilizing rollers so that they may be rotated to facilitate the welding of the circumferential seams. All of the welding of the circular, as well as the longitudinal seams is performed in the downhand position. One of the last assembly operations upon the vessel is the hanging of the heads. This sequence permits access to the interior of the vessel for the welding of details.

The holes for manways and connections are cut in the shell, the edges scarfed and the attachments with their reinforcements welded in place. The proper scarf fitup and welding sequence is very important in assembling details.

With the welding completed, the stress-relieving operation is next in order. The vessel is usually supported under the two heads. It is brought up to a temperature of approximately 1,150 deg. F., held for one hour per inch of wall thickness and then allowed to cool in the furnace slowly to 600 deg. F. It is then removed and allowed to cool in still air. The object of the stress relieving is to remove the stresses which are set up in the vessel due to the welding operation. While no metallurgical change is involved in the metal by the stress relieving temperature used, there may be a slight reduction in the tensile properties of the steel due to the treatment given.

Test Procedures

On high-pressure vessels, X-ray examination of all the main seams is mandatory by the codes and this non-de-



Stress relieving furnaces are used after welding

Installing internals in a refinery vessel

structive method of examination has proved to be an important factor in the control of the quality of the welds. The X-raying of all of the major seams of the vessel may be done either before or after the stress relieving operation, a record being made of the location of all exposures. Defects which are revealed and which exceed the standards fixed by the codes or rules in force are removed by chipping, and are re-welded and re-X-rayed. Major repairs necessitate another stress-relieving operation with subsequent examination by X-ray.

The final operation consists of subjecting the pressure vessel to the hydrostatic-pressure test fixed by the vessel specifications. Under the A. S. M. E. Unfired Pressure Vessel Code, the test pressure is set at twice the working pressure. The vessel is subjected to the pressure for at least one hour during which all welds are carefully examined for evidence of leaks. A hammer test of the welds may also be made at a somewhat reduced pressure. In this test, a hammer of definite weight is used and blows are struck at intervals on the weld seams. A chart record of the test pressures may be supplied the purchaser as a part of the vessel record. At the successful conclusion of this test, the vessel is stamped with the required data and prepared for shipment.

It is the usual practice for the purchaser to have his own inspectors or an insurance inspector present during the final acceptance test and also during certain stages of the fabrication. Both the codes and the insurance companies request the certification of the pressure test by a qualified inspector. This gives the purchaser or the user of the vessel an independent inspection assuring that the provisions of the codes or applicable rules, have been carried out.

This discussion of the fabrication of a pressure vessel refers chiefly to manual metallic arc welding. Variations of the procedure are necessary when mechanical welding equipment is used, when combinations of manual and mechanical welding are adopted or when multi-layer vessel construction is involved.

Welding Locomotive Boilers

The problems encountered in the fabrication of the cylindrical section of a locomotive boiler by welding would be quite similar to the problems which have already been studied and successfully solved in the pressure vessel field.

Due to the present design of locomotive boilers, consideration must be given to the special features of firebox design. These involve the staying of flat surfaces and the reinforcement of irregular shapes, subject to severe thermal changes and flame impingement. The supports and vibration of the boiler in service will require careful study. Welding data which have been accumulated in connection with the study of other structures and machine elements can contribute largely to the solution of these problems. in the last analysis the process of joining the sections, the materials to be used, and the welding procedures involved should closely follow those developed for pressure-vessel metallic arc welding.

Assembly Line Fabrication of Gondolas

(*Continued from page 285*)

Hangers for the drop doors are fabricated from T-irons and small flame-cut pieces of plate. They are welded on a metal skeleton table fitted with simple jigging blocks. No positioners are necessary here because the assemblies are simple, requiring little welding. The table top, however, was placed at convenient welding height for the average operator.

Underframe Jig Assures Accuracy

Elaborate underframe jigging arrangements lend speed and efficiency to the first major assembly operation. Exact alignment for welding is achieved simply by laying the constituent subassemblies where they fit in the jig. As may be seen in the illustrations, the underframes are assembled in the inverted position, the obvious advantage of this being that heavy underparts may be lowered onto the pre-aligned smaller subassemblies instead of having to be raised against them from beneath. Only the readily accessible welds are completed in this initial assembly operation. Not until the frame is reinverted is any attempt made to complete the welding on both sides.

The bolster and cross sills are first laid in position on this jig; then the center sill, which is the backbone on which all the other pieces rest, is lowered by crane between them. With all component subassemblies held securely in place between the jig uprights, assembly is completed easily and swiftly by a group of welding operators working as a team. To the center sill are attached bolsters, cross-bearers, cross ties, drop doors, reservoir tank and the AB brake valve. Underframe assembly as described is carried out on two such jigs simultaneously.

When completed, the entire assembly is lifted by crane and moved into position at the head of the first erection line, where actual car erection is begun. During this movement, it is turned right side up.

Resting partly on horses and partly on the trucks, the balance of the underframe is welded and is incorporated in a finished car foundation. The assembly is then ready to be rolled along the track to the next erection stage.

Side-Frame Fabrication

Assembling of side frames consists of welding a side plate to the top reinforcing chord (made from a regular bulb angle), then laying posts and braces across them to the bottom channel or side sill and welding the whole structure together. A staggered sequence without step-back is considered adequate for the weld joining side plate and chord. To hold the separate parts in position for welding, a jig with shop-made hold-down clamps is used.

The posts and braces also are fabricated in the shop. Rectangular pieces of plate are sheared or cut out with a Radiagraph and then formed into three-dimensional shape on a hydraulic press.

Side assemblies are swung into position on the car bodies and held firmly by heavy screw jacks which, when tightened, pull the bottom channel toward the center sill and into the grooves prepared for it in the ends of the cross sills. Fillet and lap welds fasten the bottom channel securely in these grooves.

Drop ends are assembled on a table-size jig. Corner posts of formed angle shapes are welded to the drop end gate, gussets, reinforcing top chord angle and end sills. These angle shapes, like the post and braces previously mentioned, are made by cutting out rectangular pieces of plate with a Radiagraph and bending to desired shape.

Attachments Welded in Place

Various other attachments welded into the assembly at this juncture include a bracket for a hand brake, supports for floor stringers, bracket for pin-lifter and end plate complete with hinges. The ends drop inward from hinges at the bottom. They are assembled at night and stacked

on special racks ready for car erection during the following day.

With car-frame erection completed, the wooden blocks between sill bolsters and trucks are removed, allowing the gondola to settle on its trucks. The blocks were inserted earlier to provide welding space between trucks and gondola. The car is now ready to receive its wood sides and flooring which are bolted in place.

On the second and last erection line, carpentry takes up where metal fabrication leaves off. This line bears a closer resemblance to an automotive assembly line. At one stage flooring is laid in position, at the next it is bolted, at a third it is tightened. In the same systematic way the siding is put on. Finally, step board and safety appliances are added and after a final inspection, paint is sprayed on and a finished car rolls off the line.

Test Plant Tests Pennsylvania T-1 Locomotive

(*Continued from page 282*)

burning 240 lb. per sq. ft. of grate area. Fig. 3 shows the heat balance plotted against various rates of firing. As in all locomotive boilers the largest heat loss is that due to fuel escaping unburned. At the highest firing rate, where the boiler efficiency is 43 per cent, the loss due to unburned coal is 44 per cent. However, the locomotive is rarely worked at this rate and then only for short periods.

Fig. 4 shows that the heater saves from 5 to 11½ per cent of the water, depending upon the rate of evaporation, thus, in effect, increasing the capacity of the tender.

This locomotive shows remarkably low pressure drop from the boiler to the steam chest, the maximum obtained being only 9 lb. at maximum evaporation. Fig. 5 shows the pressure loss at various rates of steam use, distributed for the dry pipe, superheater, throttle, and steam pipes. These pressures were measured with a mercury manometer.

Engine Performance

The steam per indicated horsepower hour at various speeds are shown in Fig. 6. The minimum water rate was 13.6 lb. at a speed of 76 m.p.h. and 20 per cent cut-off. In most of the tests the water rate was between 14 and 15.5 lb.

In 40 years of testing on the Altoona test plant, this locomotive gave the lowest water rate. In looking over these records it is interesting to note that after superheating came into use the improvement in water rate has only been about 8 per cent in 30 years and this is largely the result of increases in temperature and pressure of steam supplied to the cylinders.

Likewise, the maximum indicated horsepower of the T-1 locomotive is 40 per cent higher than that of any locomotive previously tested at Altoona. The maximum indicated horsepower of the T-1 locomotive on test was obtained under the conditions set forth in the table.

Conditions Under Which Maximum Indicated Horsepower Was Developed

Maximum i.hp.	6,552
Speed, m.p.h.	85.5
Cut-off, per cent	25
Boiler pressure, lb.	295
Steam-chest pressure, lb.	287
Temperature steam at steam chest, deg. F.	757
Steam to engine per hr., lb.	101,219
Steam per i.hp.hr., lb.	15.4
Total volume of cylinders, cu. ft.	35.92

The T-1 locomotive developed a maximum of 6,100 drawbar horsepower, which is 46 per cent more than that of any other locomotive ever tested on the Altoona test plant.

The principal reason for the low water rate of the T-1 locomotive when developing maximum power is that the design of the locomotive permits the maximum power to be developed at short cut-off. The ability of the locomotive to produce maximum power at short cut-off can be attributed to three factors: (1) high boiler pressure; (2) low pressure drop from boiler to steam chest due to large steam passages (this is equivalent to higher boiler pressure); (3) large admission valves due to four cylinders and poppet valves.

At very high speed the T-1 locomotive produced nearly maximum power at 15 per cent cut-off. To produce moderate power at high speed it is necessary to throttle the engine.

The machine efficiency of the T-1 locomotive is high due to the poppet valves and roller bearings on driving rods and axles. It was above 90 per cent at all speeds and horsepowers, with a high of 97.5 per cent at 38 m.p.h. and 4,500 hp.

Locomotive Performance

At low and moderate horsepowers the dry coal fired per drawbar horsepower-hour was generally below 2.5 lb. From 5,500 drawbar horsepower to 6,000 the coal rate rises from about 2.5 lb. to about 3.5 lb. Fig. 7 shows maximum drawbar pull and maximum drawbar horsepower based on a rate of 100,000 lb. of steam per hour.

The highest overall efficiency obtained was 8 per cent and the lowest 5 per cent. Except above a drawbar horsepower of 5,500 the efficiency was generally between 6½ and 7½ per cent.

An interesting comparison with the two-cylinder M-1-a locomotives of the Pennsylvania shows that the maximum drawbar horsepower developed by the T-1 locomotive was 46 per cent higher than the maximum developed by the M-1-a, although the steam to the engine per hour was only 11 per cent larger.

The T-1 locomotive was designed to haul a trailing load of 880 tons on level tangent track at a speed of 100 m.p.h. This requires a horsepower at the rear of the tender of 2,980. If wind and engine- and tender-truck resistances are deducted from the drawbar pull shown in Fig. 7, it is found that the T-1 locomotive develops 4,100 hp. at the rear of the tender at 100 m.p.h. which is about 38 per cent greater than necessary to meet the requirements. High points of the test are shown in a table.

These locomotives will out-perform a 5,400-hp. Diesel locomotive at all speeds above 26 m.p.h., as shown in Fig. 8, and if given comparable facilities for servicing and maintenance will do the work more cheaply. The disparity in Diesel and steam locomotive schedules is almost entirely attributable to coal, water and ash delays. With careful planning and the expenditure of only a fraction of the amounts spent in Diesel facilities, steam-locomotive servicing can be accomplished during the normal passenger stop. Coal chutes swinging lengthwise of the track and capable of dumping 43 tons of coal in 75 sec. have been installed. Likewise, water columns delivering 5,000 gal. per min. are in use. Hoppers capable of holding the full accumulation of ashes can be installed under tracks with sluices to wash them away. If such facilities are located at scheduled station stops, steam locomotives such as the T-1's can maintain schedules as fast as any demands impose.

An oil can bobbed with the waves caused by Sparks wading into the room

LOW HIGH LINE

By Walt Wyre

NED Sparks was on his way to the storeroom when he happened to notice the section gang preparing to go to work on the storeroom track. If the electrician had known at the time the headaches the gang of snipes was going to cause him, Sparks might not have greeted the section foreman quite so cordially, even though he knew the gang boss was only obeying orders.

"Looks like it needs fixing," Sparks said, meaning the storeroom track.

"Yeah," the section foreman replied, "but we're going to do more than fix it up; we're going to raise the track two feet and extend it towards the roundhouse six car lengths."

"Quite a job," Sparks commented casually.

That afternoon dump trucks began hauling dirt to build up the roadbed to raise the track, but the first load of dirt was not dumped near the storeroom, it was unloaded right in front of the electric shop.

"Say, what's the idea?" Sparks asked the truck driver. "I didn't order my front yard filled in!"

"Ask the division engineer," the truck driver replied good-naturedly, "I got my orders from him."

Sparks didn't ask the division engineer, that official not being handy, but he walked down near the storeroom and asked the section foreman, "Is the track going to extend as far as the electric shop?"

"Yep," the section foreman said, "that line of stakes is where the center of the track will be. The last stake is just past the edge of the electric shop."

"How high will the track be?" Sparks asked.

"Oh—let's see—'bout two feet at that end. It'll be more than that in the swag between here and that end. I disremember how much, but the figures are on the stakes," the section foreman added.

"Sure will be handy for me!" Sparks commented sarcastically, "having to haul motors and things over a track two feet high or else go around."

"Yeah, will be a little unconvenient," the section foreman said, "but I can't help it. I'm doing what the division engineer said do."

The section gang, although working shorthanded, finished the job of raising and extending the track in short order. Sparks talked to Jim Evans, the roundhouse foreman, and H. H. Carter, the master mechanic, about the track extension but both were too busy to pay much attention to what the electrician said.

THREE days after the track job was finished, it was raining when Sparks came to work. Sparks, slopping along with his head lowered, walked into the pool of water in front of the electric shop door before he noticed the fish pond. He swore, splashed on to the door and entered the electric shop. Then he swore some more. Water, backed up by the track fill and having to level out somewhere, had flowed into the electric shop and stood nearly shoetop deep on the floor. An almost empty oil can was floating around, bobbing with the waves, caused by Sparks wading into the room.

A boilermaker passing by yelled, "Hey, Sparks, how about fishing in your pond?"

Sparks went in search of the foreman to see about getting some laborers to cut a ditch for draining the water from the electric shop. While he was gone, some wag had chalked the word "hydro" above the electric shop sign on the door, making it read "hydroelectric shop." Sparks grinned a very weak and very wet grin, just using about half his mouth for the effort.

When a ditch was cut through the roadbed most of the water drained from the electric shop, leaving a coating of silt on everything on the floor, including Sparks' overalls that he had left on the floor when he peeled them off at quitting time the day before. Sparks wrung some of the water out of the sopping overalls, then carried them into the roundhouse and laid them on top of a hot locomotive boiler to dry. As he was climbing down from the locomotive, the foreman saw him and waited for Sparks to reach the floor.

"Been looking for you," Evans said. "The air compressor motor got so hot it was stinking. I shut it down."

"O.K.," Sparks said, "I'll go get my tools and look at it."

An odor of overcooked insulation and varnish pervaded the air around the 100 hp. motor and the frame was still so hot that Sparks couldn't hold his hand on it. Sparks checked the air gap to see if the bearings had worn and let the rotor drag. Air gap was O.K. all around. He next tested the fuses to see if one was blown, allowing the motor to run single phase. Fuses were all O.K. as were the contactor fingers when he looked at them. Then Sparks scratched his head. Maybe there was a loose connection at the motor, he thought. He removed the box cover and untaped the wires. All connections were reasonably tight and the lugs showed no sign of having been hot, so he retaped the connections and scratched his head again.

While Sparks was replacing the box cover, Evans came up. "Have you found what was causing the motor to heat?" the foreman asked.

"Not yet," Sparks told him, "and darned if I know just where to look now."

"Well, get it going soon as possible," Evans said. "Boilermakers have got a rush job on the 5061. The blacksmith forge is shut down and we sure need the air."

"O.K.," Sparks replied. "It shouldn't take very long unless the trouble is in the motor windings. I've looked at the fuses, motor connections, and contactors. Could be a loose connection in the starter." Sparks started removing the cover from the back of the controller cabinet.

Wires and connections looked O.K. and Sparks was ready for some more head scratching. He pulled at all of the wires that were soldered into lugs and found them solid, then felt of all the binding post nuts. They too were tight.

Sparks hesitated a moment, then decided to start the motor and see how it acted. When he pressed the button the motor came up to speed as usual, but when the running contactors closed the motor whined as though laboring with only one phase pulling. Almost immediately the hot motor smell that had almost disappeared was again evident and Sparks pushed the stop button.

"Where you going?" Evans asked when the electrician started to walk away.

"Going to the electric shop to get an ammeter," Sparks told the foreman and kept on walking.

When Sparks returned carrying the split core meter he again started the motor and hooked the meter over each of the wires in succession. The meter indicated no current in one of the wires and Sparks was still puzzled.

"Now where you going?" Evans inquired with a trace of irritation in his voice when the electrician started to leave again.

"Going to rig up a series test light," Sparks said, "and find where the open is in that line."

The trouble was soon located with the series test lamp and Sparks felt like asking some one to give his pants a kicking. A contactor jumper was broken and hanging down behind the contactor so that the loose end was out of sight.

"I'll be damned!" Evans sighed with relief. "A little thing like that shut down a 100 hp. motor!"

Sparks picked up his tools and from habit felt for his right back overall pocket, then remembered where he had left his overalls.

WALKING rapidly, Sparks went to the electric shop, laid his tools on the bench, then rushed to the roundhouse. The stall was empty where the locomotive that had the overalls on it had been. He rushed outside and looked around. The 5086—that was the engine—was not in sight. Sparks went to the roundhouse office and asked the clerk about the 5086.

"Left town about fifteen minutes ago," the clerk said. "Why? Wouldn't the headlight burn?"

"Headlight was O.K.," Sparks replied, "but I had a nearly new pair of overalls tied on top of the boiler to dry—and overalls are mighty scarce nowadays, besides my wife will give me thunder for getting my pants dirty!"

Sparks' time the rest of the day was, as history says of

Gaul in Caesar's time, divided in three parts—several odd jobs in the roundhouse; cleaning mud from the electric shop; and cussing the division engineer for the track that backed up the water and caused the mud in the electric shop and incidentally cost him one pair of overalls. But Sparks had not learned all of the trouble yet to come because of the track.

The next afternoon Sparks noticed a couple of men from the Engineering department but paid little attention to what they were doing. He found out next day when the master mechanic sent word for Sparks to come to the office.

"Say," the master mechanic began when Sparks entered the office, "How much clearance are power wires supposed to have over a track?"

"Twenty-seven feet," the electrician told him. "All of our lines have plenty of clearance. I checked them not over three weeks ago."

"How about the power lines to the machine shop over the storeroom track?" the master mechanic asked. "I've got a letter here from the superintendent that says they only clear twenty-five feet and nine inches."

Sparks didn't try to keep from swearing, then said, "The wires over the storeroom track had plenty of clearance until the track was raised two feet. It's going to be quite a job to raise them, too," he added.

"Let's go look at them." The master mechanic rose as he spoke and left the office with Sparks following.

"Wires look high enough to me," the master mechanic said. "Can you get a line and measure how high they are?"

"Yes, sir," Sparks said. "But I'm afraid it would be of no use. They just cleared the old track by very little over twenty-seven feet and the track was raised at least two feet. The wires were O.K. long as they left the track alone."

"That's right," the master mechanic agreed, "and I think I know why the division engineer had the height of the wires checked. I've been after him nearly a year to raise the track so cars would come a little above the platform level—makes unloading heavy material easier. Now he's got the track raised and getting back at me. Well, there's nothing left for us to do but raise the wires. How much of a job will it be?"

Sparks squinted one eye and looked at the pole and wires. "Pretty good-sized job! We'll have to trench that pole over and set a forty where that one is. Those six hundred thousand circular mil wires are pretty heavy to handle and the ones leading off to the fill-up and washout plant are four-naught. If we have to splice out the big line to the machine shop, as it looks like now, that means more work."

The master mechanic used a couple of well chosen swear words that expressed Sparks' sentiments exactly, then said, "Have you got a pole that could be used for the job?"

"No, sir," Sparks replied, "and I doubt if there are any secondary racks, guy cable, or any of the rest of the material in the storeroom for the job."

"Well, get it ordered and I'll write the superintendent that we'll raise the line soon as the material arrives." The master mechanic turned and went back to his office. Sparks walked to the electric shop, mentally grappling with the various problems involved in raising the power lines.

BESIDES being a fair-sized job of work, Sparks knew there would be hell to pay if the power was shut off any length of time. Everything received power from the big lines on the pole—machine shop, roundhouse, turntable, water pumping and treating plant, fuel oil station, and every other electrically operated facility in and around the shops depended on that line for current. Every official and supervisor from fuel foreman to division superintendent would be breathing down the electrician's neck wanting to know how soon the power would be on again; Sparks knew from experience. No need to try to find a convenient time to shut off the power. There is no convenient time to shut down the power at a busy railroad roundhouse.

The electrician was so busy the next two or three days that for the time at least he almost forgot about the low wires. Seemed like all of the Army was moving west via the S. P. & W. through Plainville, from the number of troop trains that went through. They ran everything that had wheels under it except the call boy's bicycle, and might have run that if the caller hadn't been on it most of the time. Besides the extra amount of work caused by running so many locomotives, there was some electrical work on the coaches of almost every troop train. Sparks worked so many hours that he forgot when his regular quitting time was.

The strain was telling on Jim Evans, too. Jim has a boy in the Pacific and he feels like that all he can do is little enough. Long hours of work and worry have deepened the lines in Evans' face and furrowed some new ones since the war started, but he says he can rest when it's all over.

After the rush of westbound main trains, things eased off a little at the roundhouse. Sparks went back to working normal time and Evans saw his wife in the daytime a couple of times. Sparks had been planning to clean up the electric shop for the past two months and finally decided he might have time to do it. He had just started pulling things out of the bench when the foreman came into the shop.

"Master mechanic called and said for you to come to the office," Evans told Sparks.

"O.K." Sparks brushed off his overalls with a piece of waste and headed for the master mechanic's office.

"COME in," the master mechanic invited. "Sit down." He indicated a chair, then asked. "How's the job of raising the wires over the storeroom track coming along?"

"Haven't done anything more," Sparks told the master mechanic. "Nothing I can do until we get a pole and the other material."

"Let's go see the storekeeper and see when the pole will be here," the master mechanic said. "Seems like somehow the chief engineer found out about the wires being too low and wrote the superintendent about it," the master mechanic said as they went to the storeroom.

"When you going to get that pole we ordered?" the master mechanic asked the storekeeper.

"Can't say exactly," the storekeeper replied, "but chances are it'll be some time. They won't ship just one pole in a car now and it may be some time before a car loaded with timbers or piling or something they can load the pole with that will be coming this way."

"Well, we've got to have a forty-foot pole," the master mechanic said, "and right away. The superintendent is raising Hades about the wires over the storeroom track being too low."

"Why don't you borrow a pole from the signal department?" the storekeeper asked. "They've got a whole pile of poles of all lengths and sizes down the other side of the B&B lumber yard."

"O.K.," the master mechanic said, "I'll call the signal supervisor. How about using the truck to drag the pole up with?"

"Not today," the storekeeper shook his head, "maybe in the morning," he added.

"Well, that'll be all right," the master mechanic agreed, then turned to Sparks and said, "What's the matter with planning to set the pole and raise the wires tomorrow? I'll see Evans and arrange to have the power shut off a couple of hours right after one o'clock. That'll give you all morning to set the pole and get everything ready."

"A couple of hours won't be long enough to change the lines over and besides, we haven't got the hardware for the new pole," Sparks told him.

"Why can't you use the insulators and things off the old poles?" the master mechanic wanted to know.

"Well, I guess we could, but it'll take quite a bit longer."

"That's up to you to figure out," the master mechanic told Sparks. "I'll see that you get a pole and tell the foreman to give you what help you need setting it. Let's go see Evans now."

"How long will it be necessary to have the power shut off?" Evans wanted to know the first thing when told about the job.

"Well, not less than six to eight hours, I'd say," Sparks told him. "Handling those big heavy wires is slow work and there are lines running in every direction from that pole."

"Good Lord," Evans exclaimed, "practically a whole day lost just raising some wires a couple of feet!"

"Well, it's got to be done and we might as well do it tomorrow as anytime." With that pronouncement the master mechanic turned and went back to his office.

"Hell!" Evans snapped, when the master mechanic was out of hearing, "we can't shut the power off no six or eight hours! We are so far behind with machine work now that it'll take a week to catch up if we don't have another rush. Can't you figure out some way to raise them wires without shutting off the power so long?"

"Don't see how," Sparks said, "but I'll do the best I can."

NEXT morning when Sparks went to the storeroom to go with the truck driver to get the pole he met the master mechanic just coming out of the office.

"Good morning," the master mechanic said. "I'm going to Sanford on No. 2, be back tonight. I'll look the job over tomorrow."

Sparks found plenty of thirty-foot poles, a few thirty-fives, and three forty-foot poles at the signal department pile, but the forties were all too small for the job. Slim and tapering, they looked more like giant fishing poles than what Sparks needed.

"Want to take one of them?" the truck driver asked.

"No," Sparks replied, "none of them would do the job."

"Let's go then." The driver stepped on the engine starter.

"Wait a minute," Sparks said. "Let's get one of them." The electrician pointed to some heavy stub poles about twenty feet long.

"They ain't more than half long enough," the driver argued.

"Well, I've got an idea that might work," Sparks told him.

When they were back at the roundhouse, Sparks found Evans and asked for a couple of laborers to dig a hole.

"I'll let you have the laborers," Evans said, "but we are sure as thunder going to delay some trains if the power is shut off six or eight hours."

"Maybe I can get the wires raised and only shut off the power an hour or so," Sparks said.

"Boy, that'll sure be fine if you can!" Evans grinned.

Sparks showed the laborers where to dig the hole right next to the pole and, "I want it plenty deep," he said. "At least six and a half feet."

The hole was dug and the short pole set in place before noon. When the one o'clock whistle blew, Sparks found the foreman and told him he needed the portable gas-electric crane a couple of hours.

"O.K., but don't shut off the power yet," Evans said. "I've got three engines to get out of the house."

Sparks found the crane operator, then told the two laborers to get a couple of track jacks. While the laborers were gone after the jack, Sparks got a piece of one-inch pipe about ten feet long and screwed a cap on one end.

The two track jacks were placed on opposite sides of the pole and setting on heavy oak boards. Sparks wrapped a chain around the pole and over the jacks to hold them. Then he wrapped another chain higher up and hooked te crane cable to it.

"Now," Sparks said, "let's all work together. Just keep the crane line good and tight and you two men at the jacks raise the pole and the crane will hold it."

Besides having a heavy load the pole was set deep and solid. It was necessary to take a shovel and dig around the pole before it would raise. Finally both jacks lifting and the crane pulling with all its power, the pole raised a little. "Keep it going," Sparks shouted.

"That's all on the jacks," one of the laborers said.

"O.K., hold everything!" Sparks grabbed the one-inch pipe and started tamping around the pole to force dirt under it. "Now let the jacks off and take a new hold," he said. "Keep the crane line light," he added.

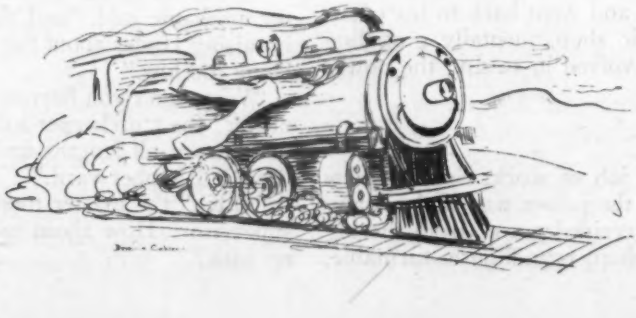
Four sets with the jacks and the pole was raised enough. The jacks were removed and the laborers dug down so dirt could be tamped solidly under the pole. Then Sparks bolted and clamped the pole to the stub. Just as he was finishing, Evans came out and said, "Now you can shut the power off."

"Don't need to," Sparks said. "The job is about done."

Next morning the master mechanic came up to look at the job. Sparks saw him and walked out to where he was.

"What was the trouble, didn't the signal department have a pole long enough without splicing it?" the master mechanic asked.

Sparks' reply sounded like he swallowed his Adam's apple and choked on it.



EDITORIALS

The Future of Material Handling

In order to minimize costs and assure the most favorable competitive position possible when war transportation needs decrease and railroads are again looking for more business, it is important that railroad men start now to review and further improve their methods of handling materials and supplies of all kinds, particularly the vast quantities required in the operation and maintenance of rolling stock.

Take the matter of locomotive coal and water, for example. Railroads pay more for locomotive coal than for any other single item of supplies and the cost of water also is a substantial figure. With the stepped-up tempo of modern railway operation, it is of the utmost importance to place these supplies on locomotives with minimum delay, and coal chutes capable of dumping 43 tons of coal in 75 seconds have been installed, also water columns delivering 5,000 gal. a min. at some terminals. Similarly, facilities for supplying heavy fuel oil to steam locomotives and lighter grades to Diesel locomotives have been installed and need reconsideration with an eye to the future.

Hardly less important than equipment for handling coal and water quickly to steam locomotives is the provision of adequate means for cleaning fires and disposing of ashes with minimum delay. Special equipment for this purpose has been developed and installed at many terminals but many others remain to be equipped. In connection with coal, water and cinder-handling devices, railroads are, as often happens, placed in something of a dilemma. With entirely adequate equipment, for example, at nearby engine terminals, it may be necessary to install additional facilities at selected main-line stations in order to permit running locomotives through and thus secure high utilization of power, as well as avoiding the delay attendant upon changing locomotives. In other words, the primary objective in railroading is to move trains, and special operating requirements frequently necessitate the provision of what would appear in some instances to be almost duplicate fueling facilities.

Similarly, in the servicing of cars, both passenger and freight, large economies can be effected by providing adequate means for supplying all necessary materials quickly and with minimum hand labor. Normally, few supplies are required for passenger cars en route, but a great quantity of materials such as propane gas cylinders, axle generator drives, brake shoes, brake beams, wheels and other mechanical equipment must be available and arranged for rapid handling in order to speed up the turning of passenger cars at terminals. In the case of ice-activated air-cooled cars the problem of ice supplies also presents itself at intermediate terminals. Supplies of many different kinds for freight cars are required at all transportation yards and terminals and it is of the utmost importance, that modern equipment be available for handling and applying these materials with minimum delay and manual labor.

The handling of materials at railway shops and terminals where either light or heavy repairs are made to locomotives and cars constitutes a major problem and, in spite of the great progress effected at some points, many others are still using more or less "strong-arm" methods. Material handling at railway shops naturally divides itself into two general categories, namely, raising or lowering and transverse movement. Thinking about locomotives, for example, the easiest and quickest way to take out the trucks and driving wheels is to provide a shop crane of adequate capacity to raise the locomotive as soon as the main rods, brake beams, binders, etc., have been removed. In some smaller shops, however, where the number of locomotives repaired annually does not justify a large building with relatively expensive overhead traveling crane, electrically operated hoists or drop tables provide the means of removing wheels and this type of equipment is almost exclusively used for that purpose in smaller shops and enginehouses.

Associated with the lifting of locomotives and cars with cranes or electric hoists is their transverse movement for short distances in shops or repair yards for more easy or efficient performance of repair work. This is not commonly thought of as material handling, but it really does constitute moving material in a big way. For example, the adjustment of locomotive position on a shop track while setting valves is done in a great many shops with locomotive spotters, and car pullers, operated by electricity or air, are widely used for pulling cars into shops or at periodic intervals while cars are being given progressive repairs inside. The situation at every major shop, and smaller points as well, should be reviewed to make sure that it is adequately equipped in this particular in the light of probable future needs.

For handling smaller locomotive and car parts and materials, it is safe to say that railway shops and repair points would be completely bogged down under present labor conditions without the power-operated mobile equipment which does so much to increase shop output and reduce manual labor. This equipment utilizes either gasoline, gasoline-electric or straight electric power and consists primarily of crane-equipped trucks, lift trucks, fork trucks, individual delivery trucks, tractors and the

necessary trailers of standard or special-purpose design.

On the basis of information submitted to *Railway Mechanical Engineer,* railroads ordered and for the most part installed in 1944: 195 hoists other than pit jacks which may be compared with 136 in 1943; 486 power jacks were ordered in 1944, compared with 312 in 1943; 351 tractors, trucks and transfers were ordered in 1944, compared with 209 in 1943. The substantial increase in orders for this type of equipment in 1944 compared with 1943 indicates an increasing appreciation of its importance by progressive railway mechanical supervisors who are responsible for shop, enginehouse and repair-truck output. One of the most constructive things they can do, as suggested, in an earlier paragraph, is to review the performance of their present material-handling equipment and make sure, insofar as possible, that it is adequate to meet future requirements.

Lighting Vs. Building Design

A few weeks ago, a group of railroad electrical engineers in discussing lighting of railroad buildings, agreed that no adequate means of lighting enginehouses had yet been evolved. The nearest approach to good lighting probably consists of spread-lens enclosed reflectors or angle reflectors mounted on the columns between stalls. To obtain adequate distribution, the lighting units are usually mounted on stems away from the side of the locomotive to be lighted with the light projected back across the space between stalls. They should be high enough to throw some light on top of the locomotive, but at this elevation they are frequently so far up in the smoke that much of the light is cut off and keeping the fixtures clean becomes so difficult that no one does anything about it. And even when the fixtures are at the desired height, the crane truck frequently knocks them down while applying or removing rods and pumps.

Some promise is offered in the form of fluorescent fixtures consisting of flat reflectors and two 100-watt lamps, the units being hung on chains to permit their swinging when nudged by crane booms. But the best the lighting engineers can do would be materially improved by the cooperation of the building designers.

If adequate lighting in an enginehouse is important, it can be obtained by increasing the height of the building, by improving ventilation and by increasing the space between stalls. An increase in crane truck capacity would also assist the lighting engineers and in many cases reduce time of operations in the enginehouse. The increased height of the building and the better ventilation would of course raise the smoke level. This would permit of better light distribution and assure a reasonably long period between fixture cleaning times. The wider space between stalls would also allow for better light distribution and would improve working conditions. Many of the crane trucks now in service are scarcely adequate for the increased duties they are expected to perform. The limited capacity and the limited space frequently requires considerable jockeying to get the crane in a position where it can lift with an almost vertical boom. This takes time and frequently also knocks down the lighting fixtures.

Since lighting engineers have tried so long with only moderate success to light an enginehouse, perhaps it is time for the building designers to give them a break.

Are Riders Needed On Diesel Locomotives?

As the number of months and years go by in which Diesel-electric road locomotives pile up service mileage it is interesting to observe the attitude that operating and mechanical officers and supervisors have toward certain phases of the operation of this type of power. Until actual records of performance had discounted many of the theories held by individuals in the early stages of its use the Diesel-electric was the object of unfavorable comparisons in the matter of cost. Fortunately for the proponents of Diesel power there are available more comprehensive and accurate operating-cost data with respect to its use than is the case with steam power.

It is of value, therefore, to have an opportunity to examine the operating costs of a group of both freight and passenger Diesels that have been in continuous service since the last half of 1941. It is not intended here to go into detail except to present sufficient data to form a background for a discussion concerning "riders", or, as they appear in the statistics, "attendants". The question under discussion on many roads is, "Shall we take the riders off, or leave them on?"

Possibly a study of the operating cost records may help throw some light on the subject. Here are some costs on one road:

Year ended June 30	Maintenance cost per unit-mile		Operating cost per unit-mile	
	Freight	Passenger	Freight	Passenger
1942	$0.080	$0.117	$0.136	$0.091
1943	0.111	0.122	0.173	0.104
1944	0.119	0.135	0.183	0.112
1945*	0.115	0.151	0.184	0.116

* 10 months only.

Note: The unit in freight service is a two body unit, 2,700 hp.; in passenger service a single body unit, 2,000 hp.

In the figures in the accompanying table the maintenance cost includes the cost of attendants and the operating cost is exclusive of the wages of engine crew. At the end of April, 1945, the passenger locomotives had operated over 30 million unit miles and the freight locomotives over 7 million unit miles.

Equally interesting are the percentage ratios of labor, material and attendants in the maintenance cost figures shown above. These appear in the second table.

	Labor		Material		Attendants	
	Freight	Passenger	Freight	Passenger	Freight	Passenger
July 1942 ..	45.2	39.4	12.7	46.1	42.1	14.5
July 1943 ..	28.5	39.2	24.5	45.5	47.0	15.3
Jan. 1944 ..	30.9	40.2	30.5	45.3	38.6	14.5
July 1944 ..	33.2	40.3	30.9	45.4	35.9	14.3
Jan. 1945 ..	34.3	38.5	37.3	48.8	28.4	12.7

These percentage relationships to total maintenance cost indicate the changing conditions under which this power is operataed. As the equipment passes out of the initial period of use and both operating and mechanical departments become more familiar with it there are many evidences that, being a piece of machinery operating in rail transport service, the maintenance cost relationships will, in the long run, not differ so widely from steam or electric locomotives.

Many railroad officers are discussing the possibilities of removing riders from road Diesel locomotives. To those who view this action from the standpoint of expense alone it may be worth while to suggest a very careful study of the maintenance cost records of those roads that have done so. It may be discovered that it will be worth while to look upon the rider, or attendant, in exactly the proper light, namely that of a combined inspector and repair man who is one of the best examples of preventive maintenance that we can think of at the moment.

One chief mechanical officer, faced with pressure from management to reduce expense in this manner expressed himself as being entirely willing to charge the entire expense of riders to the locomotive repair account in full confidence that by so doing the combined labor and rider cost would be no greater than the increased labor costs where no riders are used.

A Critical Time For the Car Department

A study of the accompanying table should make it easy to pick out the railroads upon which the car-department officers are being strongly urged to repair and return bad-order cars to service. The figures shown represent the reported bad-order position of each road on May 15 of each of the last three years; the national figures have been: 1943, 2.8 per cent; 1944, 3.0 per cent; 1945, 3.6 per cent. It happens that the 1945 national average is the same as it was for the same date in 1942.

Anyone who believes that the May, 1945, percentage of bad-order cars can be forced down later in the year to the low level of 2.5 per cent for November and December, as was the case in 1942, is unaware of the real condition of the car inventory today. This year we are dealing almost entirely with the same cars that were in the inventory in 1942, cars which in the meantime have accumulated previously unknown highs in both car-miles and ton-miles, cars which have received a minimum of repair attention, tens of thousands of them now being long overdue for class repairs, and that face the prospect of a continued intensive use which may even exceed that to which they have previously been subjected in length and speed of runs, and distances between regular inspection points.

It is important that these facts be recognized. Car departments can do only so much and despite their best efforts the bad-order car situation will grow increasingly worse during 1945, not better as it did in 1942. The figures shown include only five days of operation under the new A.A.R. emergency order permitting the short routing home of cars which cannot be made fit for rough loading by the expenditure of approximately $130 or $105, respectively, in the case of all-steel house cars and all-steel open-top cars. Already the effect of the order is beginning to show in a marked increase in the percentage of bad-orders on some roads.

May 15 Bad-Order Condition Reports of Roads Owning 10,000 or More Freight Cars*

	1943	1944	1945
Delaware & Hudson	3.4	2.9	2.7
Delaware, Lackawanna & Western	2.7	3.2	4.8
Erie	2.7	4.1	3.5†
Grand Trunk Western	4.1	5.6	4.2
Lehigh Valley	2.2	2.4	3.1
New York Central	3.1	3.5	4.2
New York, Chicago & St. Louis	2.2	3.0	2.8
New York, New Haven & Hartford	3.1	2.3	4.1
Pere Marquette	3.3	2.8	2.6
Pittsburgh & Lake Erie	2.6	3.1	4.2
Wabash	1.7	2.9	3.6
Wheeling & Lake Erie	3.0	2.4	4.0
Baltimore & Ohio	2.9	3.1	4.9
Bessemer & Lake Erie	3.3	4.0	3.8
Central Railroad of New Jersey	1.3	3.0	5.5
Pennsylvania	3.2	3.8	4.5
Reading	2.3	2.2	2.8
Western Maryland	0.9	1.1	0.8
Chesapeake & Ohio	1.2	1.4	1.4
Norfolk & Western	1.8	2.7	2.0
Virginian	1.9	2.3	3.4
Atlantic Coast Line	2.7	3.1	1.8
Illinois Central	1.1	1.2	1.4
Louisville & Nashville	2.0	3.6	5.1
Seaboard Air Line	2.0	2.3	2.3
Southern	1.6	1.6	2.9
Chicago & North Western	5.2	4.1	3.7
Chicago, Milwaukee, St. Paul & Pacific	1.5	1.9	2.2
Great Northern	2.4	1.8	3.6
Northern Pacific	3.5	3.5	4.1
Atchison, Topeka & Santa Fe	3.6	3.0	4.0
Chicago, Burlington & Quincy	2.8	3.2	2.3
Denver & Rio Grande Western	3.0	3.4	5.6
Southern Pacific	2.8	3.1	3.6
Union Pacific	2.9	3.0	5.1
Missouri Pacific	1.8	2.0	2.3
St. Louis-San Francisco	3.6	2.5	2.1
Texas & New Orleans	3.0	4.2	3.5

* Does not fully reflect the effect of the emergency short-route-home order of the A.A.R. which went into effect May 10, 1945.
† Previous report.

Undoubtedly, a determined effort will be made to repair cars currently but as the deferred maintenance on equipment has accumulated each individual repair job involves the expenditure of more man-hours and the use of greater quantities of material. Before the end of the year the full railroad transportation job in this country in furthering the war effort against Japan will be accomplished only as the car-repair shops and the rip tracks of the railroads can keep enough freight cars in service. No one should minimize the possibility of serious transportation tie-ups resulting from car shortages. Obsolescence, normal and accelerated depreciation, and deferred maintenance are all working to make the job of the car department harder as the need for cars shows no signs of declining. It will take good organization, more men, an adequate and free-flowing supply of material, and full support from top management to enable the car departments to meet this test.

IN THE BACK SHOP AND ENGINEHOUSE

Holding Locomotive Parts For Machining Operations

*By J. R. Phelps**

The illustrations show a number of devices which are useful in holding locomotive parts for necessary machining operations. They will prove time savers in any shop

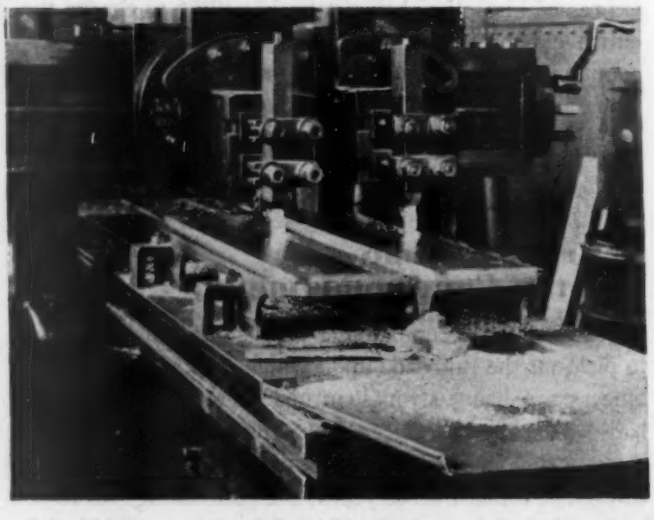
Cylinder back head mounted on boring-mill table by the use of specially designed clamps which provide clearance for the guide blocks on the head

and are especially important where the monthly shop output is high and savings in machine set-up time can mean the release of additional units.

The second photograph shows a clamp which is used for holding locomotive tires on the boring mill table for boring the inside or turning the outside of the tires. The foot of the clamp slides in the slot on the boring mill table and the upper part of the clamp extends over the tire. All bolts, blocks and other clamps are eliminated and every bit of pressure applied through the set screws in the clamps is a downward holding pressure. The blocks on the table on which the tire is set are tongued on the bottom to fit the table slots and are checkered on the top to keep the tires from sliding. The use of these clamps and blocks permits setting the inside flat face of the tire at an even distance above the table surface and assures accurate machining and means that no variation in spacing will be encountered when applying the retaining rings when tires are mounted on the wheel centers.

The clamps shown are for machining a back cylinder head on a boring mill. Where the guide blocks are cast solid on the back heads an extra high chuck jaw is required to hold them. This is also true with some designs of front heads. The jaws shown in the photograph can be made in the blacksmith shop and will prove more satisfactory for machining the inside of back cylinder heads than is the practice of blocking these parts up on the table under the regular chuck jaws. Suitable adjustments for leveling are obtained from the set screws in the bottom of the clamp and the angularly set top screws give both lateral adjustment and serve to hold the work piece firmly in position.

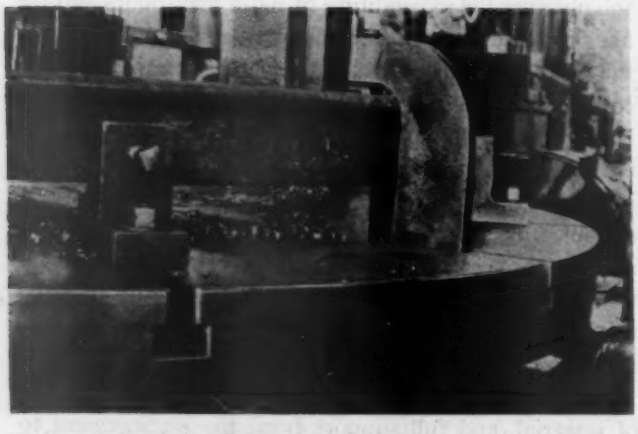
The illustration below shows a fixture which is used on a planer bed for planing crosshead liners. The liners, after having been drilled and tapped, are mounted



Crosshead guides, after being drilled and tapped, are held on this planer fixture with cap screws

on this fixture. The standard tapping for the liners is a ½-in. standard thread and ½-in. cap screws are used with the fixture. They are applied from the under side and threaded into the drilled liners and are then tightened with a ratchet-type socket wrench. This fixture is made from a 10-in. channel, two sections of which are welded together side by side. A toe is welded on to the side section of the channels to give a total height to the fixture of 4⅜ in. from the table bed.

A holding fixture, not illustrated, is used in the drilling and tapping of crosshead liners before they are machined on the planer. This is so built that nine liners can be squared against the back and one end of the fixture and held firmly in position by set screws. A drilling tem-



Holding clamps designed to position locomotive tires properly on the table of a boring mill

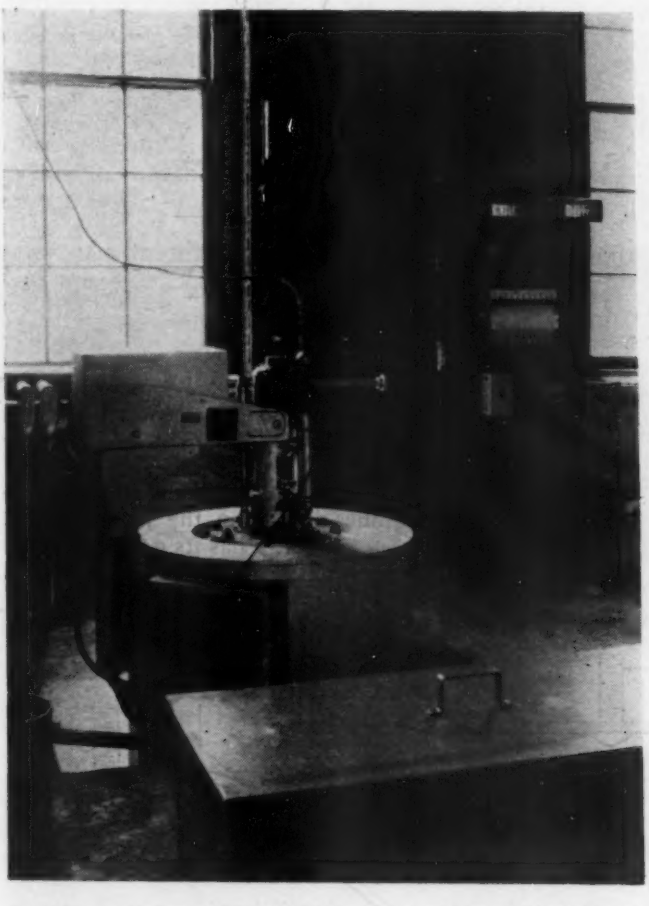
* Machine shop foreman, Atchison, Topeka & Sante Fe, San Bernardino, Calif.

plate is clamped in the bundle as the top sheet. It serves as the drill guide and makes the drilling and tapping of these parts on a standard drill press a very simple matter. The use of this fixture together with the one described for the planing of these parts results in a very considerable saving of time.

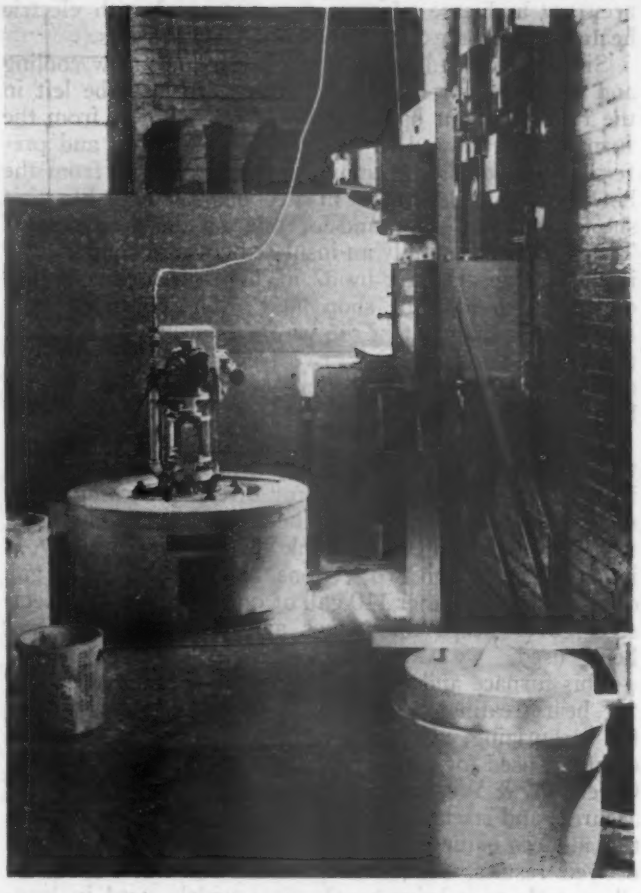
Carburizing Furnace at G. B. & W. Blacksmith Shop

An important item of new equipment, recently installed in the Green Bay & Western blacksmith shop, Green Bay, Wis., is the Hevi-Duty electric furnace, shown in two of the illustrations and used for annealing, hardening and carburizing locomotive spring pins and bushings, valve-gear links and blocks, valve-motion pins and bushing, etc. The unit has not been in service long enough to demonstrate possible economies, but it is anticipated that the service life of locomotive parts effectively heat treated and surface hardened will be more than doubled.

The electric carburizing furnace, illustrated, is an HD-1020 type, located for convenience of operation in a concrete-lined pit in the blacksmith shop floor and fully equipped, with electric controls, indicating and recording pyrometers, etc., mounted on the switchboard panels on the adjoining wall. The furnace proper comprises a heavily-insulated sheet-metal cylinder, roughly 40 in. in diameter by 40 in. high, set vertically in the pit and constructed with zone electric heating elements built into the side walls around the loading space.



Hevi-Duty electric carburizer installation at the G. B. & W. blacksmith shop with control panels in the background and quenching tank in the foreground



The cooling chamber shown in the foreground—Baskets for holding parts in the furnace are shown at the left

An electrically operated cover, which rests on and seals the furnace, is also thoroughly insulated and contains a built-in electric fan which circulates carburizing gas, generated from Carbonol fluid, delivered to the furnace through a small copper-pipe connection to a wall-mounted tank.

Inserted in the furnace and supported from a flange at the top is a closed retort, made of a cast alloy and designed so that the top of the rim has a groove and asbestos gasket to make an air-tight joint when the top cover plate is lowered into position and secured with the eight holding bolts and nuts. The work-holding baskets or pots, also made of a nickel-chromium alloy, are designed with removable perforated bottoms so as to permit and, in fact, direct the flow of carburizing gas upward through the charge. The total work-loading space is 9¼ in. in diameter by 19½ in. high and this may be utilized in a single basket or stacked baskets of smaller size. The lower basket rests on a grate-like support which does not impede the flow of gases through the perforated bottom.

In operation, therefore, the charge of work in this electric furnace is brought to the desired temperature and carburizing gas circulated downward through the space purposely left between the walls of the retort and the basket and upward through the center of the basket and its contents. At the top of the basket part of the gas leaves the retort through an outlet pipe in the cover, but the remainder is re-energized with inflowing fresh gas and recirculated.

This forced circulation of carburizing gas, cracked into its active components, is continued as long as required dependent upon the type of steel used in the locomotive parts and the depth of case hardening desired. The

accuracy and ease of temperature control with electric heating contributes to uniformly reliable results.

Since carburized parts sometimes require slow cooling and reheating for hardening, these parts may be left in the retort without opening the cover, removed from the furnace and allowed to cool outside. Another and preferable method is to remove the parts quickly from the hot retort and place them in a cooling chamber like that shown in the foreground of one of the illustrations. This chamber is simply an insulated covered container 19 in. in outside diameter by 37 in. high set for about half of its length into the shop floor. The cover is easily lifted and swung out of the way by the hand lever. At the left of the same view, two baskets of different size are shown ready for loading with parts to be carburized.

The other view shows the furnace installation with electric controls and pyrometer equipment mounted on panels between the two windows. For direct quenching when necessary, the tank shown in the foreground of this view is used. This welded steel tank is 24 in. by 24 in. by 48 in. and divided into two sections, one containing 110 gal. of water and the other 110 gal. of quenching oil. A sheet-steel cover keeps this water and oil clean when not being used.

This furnace and equipment, while designed primarily for heat treating steel parts in controlled atmospheres for carburizing, nitriding or dry cyaniding, is also successfully used for general hardening and annealing work. Green Bay & Western experience indicates that the more accurate and scientific heat treatment, made possible with this modern equipment, is really essential in order to get desired results, both with plain carbon steels and the alloy steels now being much more widely used in locomotive construction.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Laying Out Staybolts in Door Sheets

Q.—Is it satisfactory, when laying out the staybolts for a firebox door sheet, to take the maximum pitch of the staybolts as computed for the flat plate and locate the first row of staybolts from the corner flange, by taking this distance as the pitch from the point of tangency of the corner radius to the first row of staybolts?—E. A. D.

A.—It would be satisfactory to take the pitch of the first row of staybolts from the point of tangency of the corner radius providing the firebox door sheet and the wrapper sheet are at 90 deg. to each other. According to the A. S. M. E. formula, the pitch from the staybolts next to the corner to the point of tangency of the corner curve shall be:

$$p = \frac{90\sqrt{C\frac{T^2}{P}}}{a\ \text{(angularity of tangent lines)}}$$

where p = maximum pitch measured between straight lines passing through the centers of the staybolts in the different rows, which lines may be horizontal, vertical, or inclined, in.

P = maximum allowable working pressure, lb. per sq. in.

T = thickness of plate in sixteenth of an in.

C = 112 for stays screwed through plates not over 7/16 in. in thickness with ends riveted over.

C = 120 for stays screwed through plates over 7/16 in. in thickness with ends riveted over.

a = angularity of tangent lines (Fig. 1).

An analysis of the formulae might clear up this question.

$$p = \frac{90\sqrt{C\frac{T^2}{P}}}{90}$$

$$p = \frac{90\sqrt{C\frac{T^2}{P}}}{135}$$

$$p = \frac{\sqrt{C\frac{T^2}{P}}}{135}$$

$$p = \frac{2\sqrt{C\frac{T^2}{P}}}{3}$$

$$p = \frac{90\sqrt{C\frac{T^2}{P}}}{180}$$

$$p = \frac{\sqrt{C\frac{T^2}{P}}}{2}$$

Fig. 2, 3 and 4 show clearly the effect that the angularity of the tangent lines has upon the formulae. In Fig. 2, showing a 90-deg. corner, p has its greatest or full value. In Fig. 3, showing a 135 deg., the value of p is

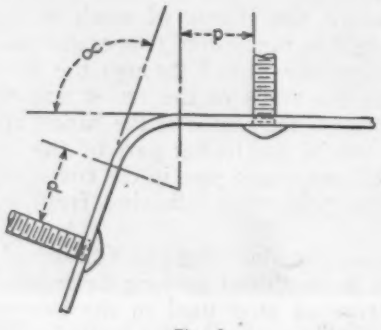


Fig. 1

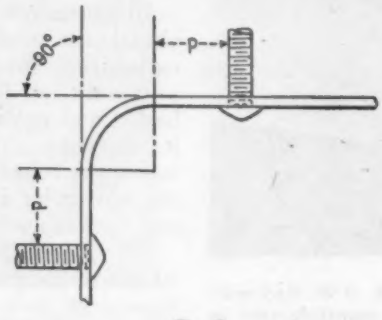


Fig. 2

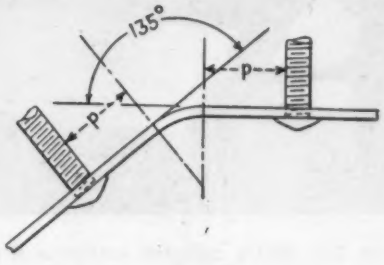


Fig. 3

reduced as the sheets tend to flatten out, the value received from the strength of the corner becoming less. Fig. 4, showing a 180-deg. corner, which is a flat plate, the value of p is the least, the pitch of the staybolt receiving no

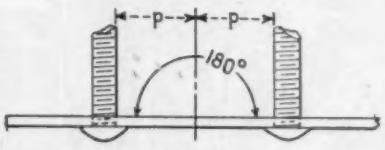


Fig. 4

support from the corner. From these three figures it can readily be seen that the angularity of the tangent lines is the determining factor as to how the value of the strength of the corner influences the pitch of the staybolts.

Welding Flash Plates In Locomotive Tenders

Q.—The swash plates in some tender tanks were welded to the tender bed with ¼-in. fillet welds, the swash plates being ¼ in. thick. Would the job have been stronger if these swash plates had been secured to the bed with a vee-weld?—R. A.

A.—In calculating the strength of fillet welds, made by the shielded-arc process, the stress is computed through the throat of the fillet. The throat of an ordinary 45-deg. fillet weld is taken as 0.707 of the size of the fillet weld. This for a ¼-in. fillet weld would be .25 x 0.7 or 0.175 in. In computing the strength of a vee-weld, the weld is taken as the same as the cross-section of the plate, in the case of a ¼-in. plate this would be 0.25 in.

It will be seen from the following table that the vee-weld is the stronger but the fact that the swash plates rest on the top of the tender bed makes the fillet weld the more desirable to use in securing the plate to the bed.

Value of welds in shear per linear in.	
Fillet weld, lb.	0.175 x 13,600 = 2,380
Vee-weld, lb.	0.25 x 13,600 = 3,400
Value of weld in tension per linear in.	
Fillet weld, lb.	0.175 x 16,000 = 2,800
Vee-weld, lb.	0.25 x 16,000 = 4,000

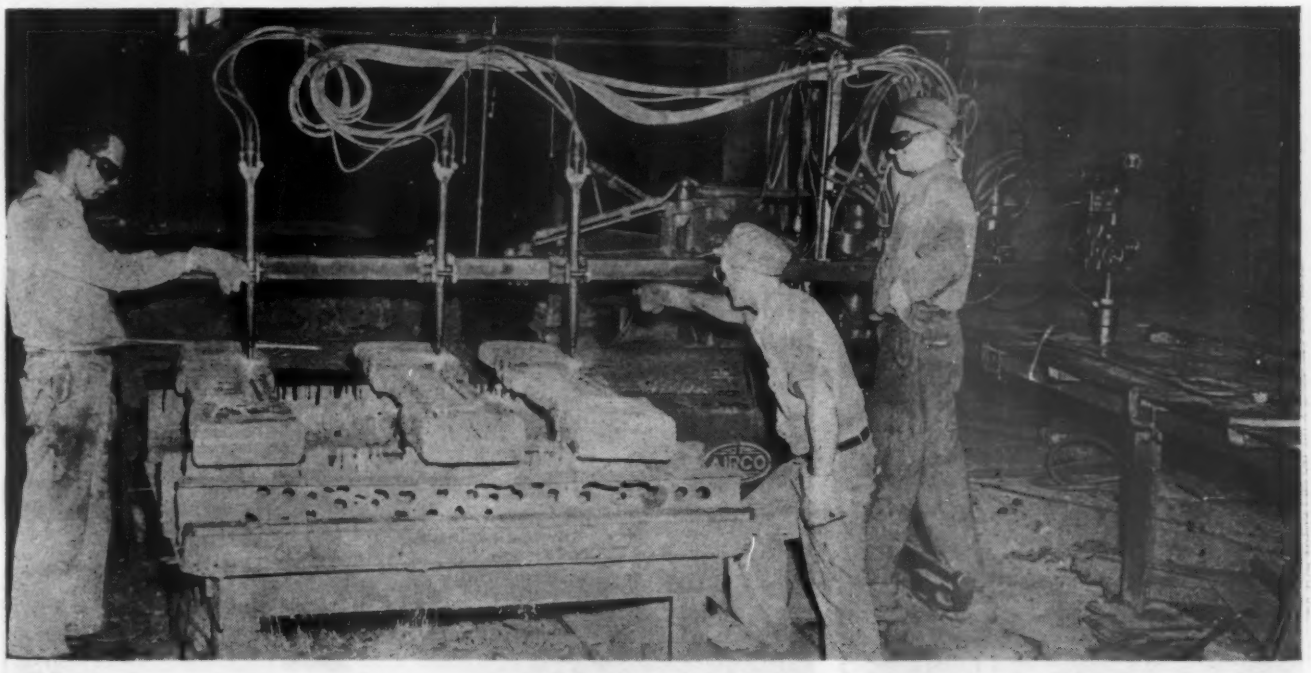
Where the question of strength is involved, it would seem preferable to use a fillet weld on both sides of the plate. The general practice in securing swash plates to tender beds is to use a ¼-in. chain fillet weld 3 in. long on an 8-in. pitch.

Multiple Torch Cutting of Side Rods for Locomotives

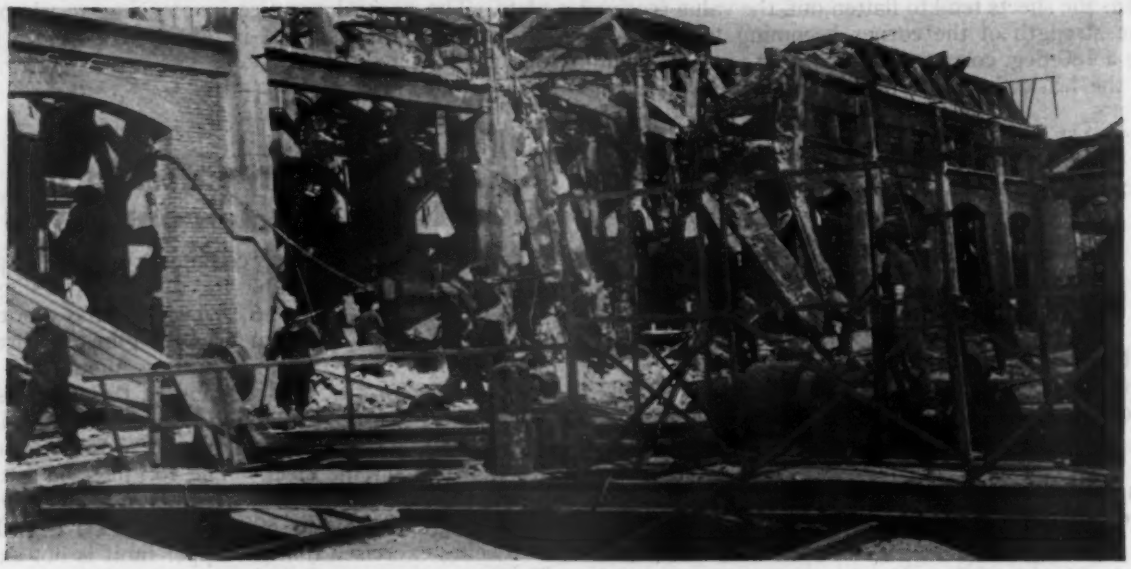
Locomotive side rods are commonly cut to shape from rolled or forged steel blanks by the use of a single oxy-acetylene cutting torch. However, at the plant of the Barium Steel Company in Canton, Ohio, a three-torch machine has been used for cutting thousands of side rods. Steel for the side rods cut at this plant is of the 1045 analysis, forged to rough shape. The forgings are checked with a scribing template and two reference marks are punched on the steel. The forgings, in batches of three, are then placed in a heating pit and preheated to a temperature between 500 deg. and 600 deg. F. with care being exercised that the upper limit is not exceeded. The next step calls for placing and aligning the pieces on the cutting table where they are descaled with a round multi-flame descaling tip which is passed over the line of cut to remove forging scale. This scale must be removed to prevent its interference with cutting.

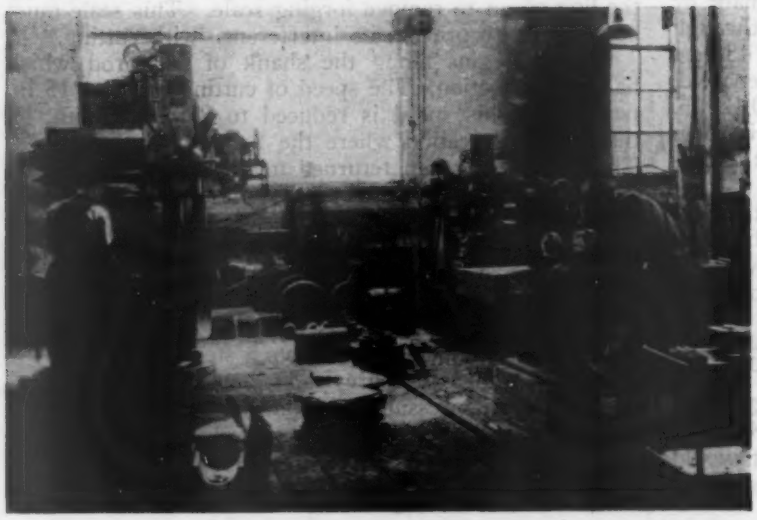
Cutting begins along the shank of each rod which has a 2-in. section. The speed of cutting is up to 15 in. per min. This speed is reduced to 8 in. per min. on the 4-in. end section where the first cut is terminated. The torches are then returned to the starting point and cutting is resumed in the opposite direction with a speed of travel of 6 in. per min. on the 5-in. end section. The cut then continues along the shank until severance is completed. Adjustments in torch elevation are made manually by the machine operators. The Airco Travograph which is employed is equipped with a magnetic tracing device and is guided from a steel template.

Oxygen gauge pressure is 50 lb. per sq. in., a comparatively high pressure being needed to assure penetration of the cut through adherent scale on the forgings. Heavy pre-heat cutting tips are used. Cuts are made to within ¼ in. of the finished size of the rods.



Three side rod blanks being flame cut to rough size in a single operation





753rd Railway Battalion Rebuilds Italian Railroad System

THE officers and men of the Army Transportation Corps had only ruins to work with when they began the job of rebuilding the Italian railways. The photograph at the top of the page shows what was left of an enginehouse after German bombs got through with it. At the left Staff Sergeant Stephen Heinrich of Chicago is busy laying out a new crosshead to replace one that the retreating Germans had destroyed. T/3 George Steubben of Marshall, Texas, is shown, below, facing the joint of a dry pipe on a horizontal mill salvaged from a bombed-out Italian arsenal and rebuilt by the 753rd.

With the Car Foremen and Inspectors

New Wheel Track on The Lehigh & New England

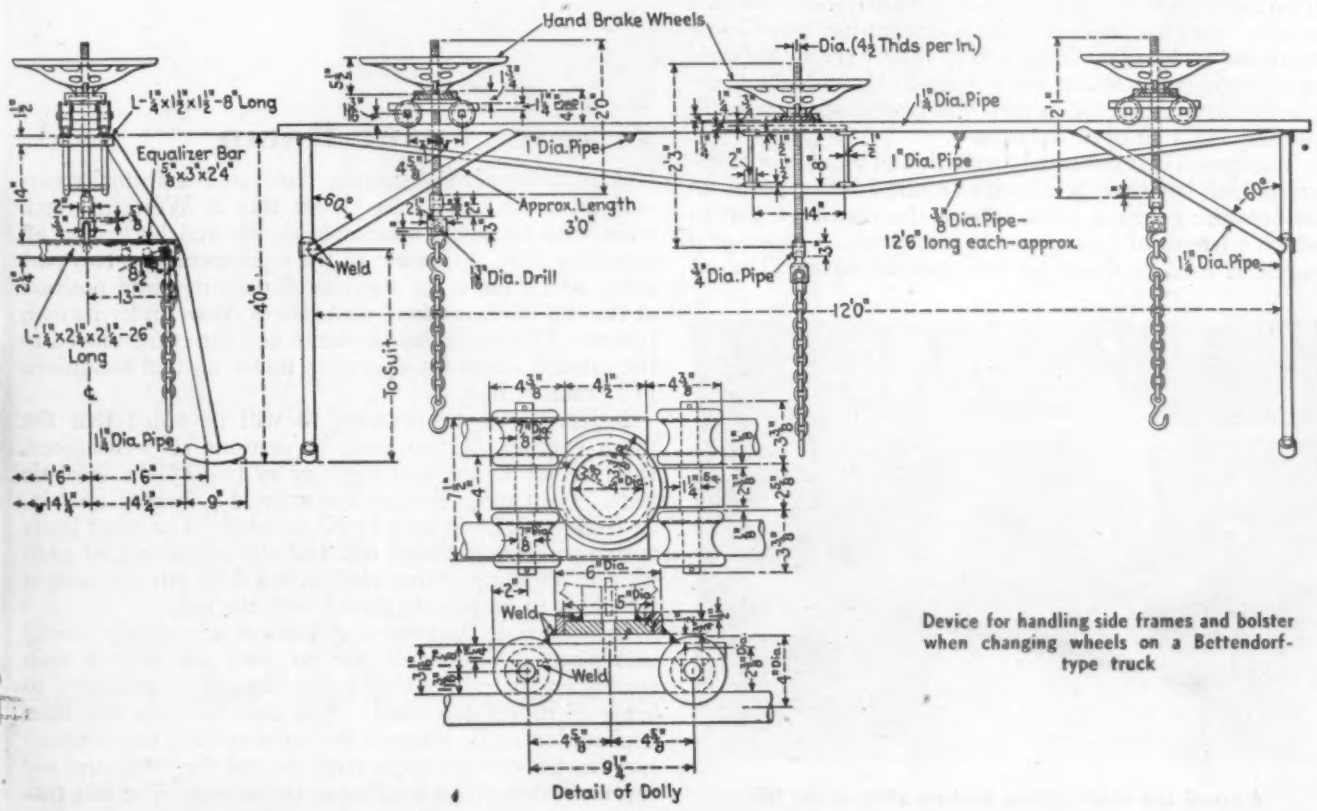
The Lehigh & New England has relocated its wheel track at Pen Argyl, Pa., and installed the facilities which are shown in the illustrations. The relocation has resulfed in time saving on car movements which averages better than a day per car and eliminates a number of extra shifting movements on each car requiring the changing of wheels. The new facilities still further reduce the repair-track time and the labor required per wheel change.

As now located the wheel track is adjacent to the principal receiving yard and cars needing new wheels are drilled out of trains and left on the wheel-track lead. The track to the wheel-change location is graded so that cars are easily moved down it to the working area. When a wheel change has been made cars continue through onto a holding track from which they are removed by yard switchers for placement in trains.

The layout of the working location is unusual. Crane service for handling wheels being removed or applied and for unloading or loading wheel cars is provided by a five-ton capacity Chisholm-Moore electric hoist which has a pendant control station and is mounted on a monorail craneway which extends across the wheel-change and wheel-storage tracks.

There are two new-wheel storage tracks having a length of 117 ft. and two old-wheel tracks which are 60 ft. in length. The wheel-change point has platform planking for a distance of 48 ft. on each side of the track at the changing spot and there is a 10-ft. planked area between the rails at the center of this outside planked working space. A storage platform for side frames, bolsters, springs, brake beams and other truck parts adjoins the immediate working area. A small tool shed and oil house with a record desk is located at the end of the platform.

The new wheel track of the Lehigh & New England at Pen Argyl, Pa.



Device for handling side frames and bolster when changing wheels on a Bettendorf-type truck

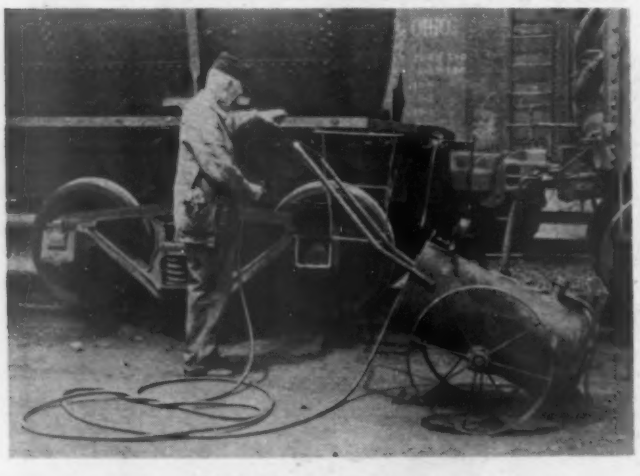
Planked areas provide a good working location for the car repairers

Two Duff-Norton 50-ton air-operated jacks have been installed for raising cars from which trucks are to be removed. Trucks, after removal, are worked under a portable A-frame type device built at the Pen Argyl shops. The frame is similar to the one in use on the Chicago, Burlington & Quincy which was described in the June, 1944, issue of the *Railway Mechanical Engineer*, page 278. The drawing appearing with this article was prepared by an L. & N. E. draftsman working from the illustration appearing on page 279 of the issue mentioned.

Service Carts for The Car-Repair Track

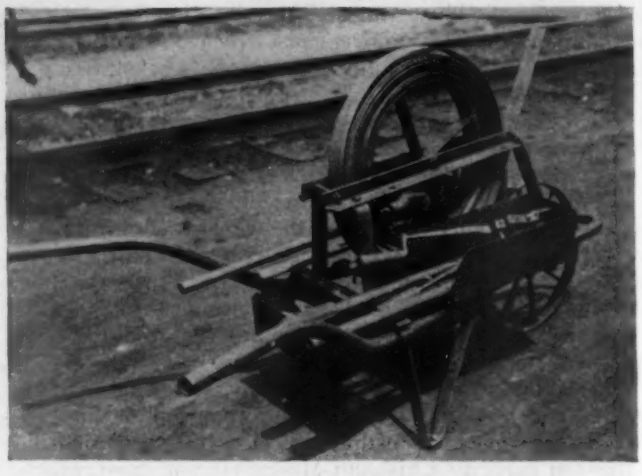
Two devices for car-repair yards which have resulted from the Erie's encouragement of job analysis on the part of employees are now in general system use after being tried out at Marion, Ohio, where they were first developed. One is an oil cart for the use of the car oilers, the other a service cart for carmen and inspectors engaged in banding loads on open-top cars.

The car-oil cart consists of a portion of an old air reservoir which has been fitted with required filling ports, an air-pressure gauge, a relief valve and a discharge port to which a length of ½-in. hose is connected. A pistol-grip nozzle is used to direct oil into journal boxes. The oil capacity of the cart is 10 gal. and when this amount of oil has been put in the reservoir the filling port is closed. A connection is then made to the shop air line and the reservoir is charged with air up to about 50 lb. pressure. When so charged with oil and air under pressure the cart can be used by the car oiler to service between 50 and 60 cars. The ease of its use has resulted in a generally more satisfactory condition in the journal boxes of cars leaving yards where it is used. Car oilers need no longer make repeated trips for fresh supplies nor carry heavy cans of car oil for considerable distances.



A car-oil cart which replaces hand-can oiling on the Erie

The banding cart is made in wheelbarrow style and carries all necessary tools and supplies for a gang doing this work. The one shown has on it a roll of 2-in. high-tensile steel banding, a banding machine, band stretcher, cutters, banding seals and stake packet protectors. The reel for the roll of banding makes the handling of this material much easier and safer for workmen.



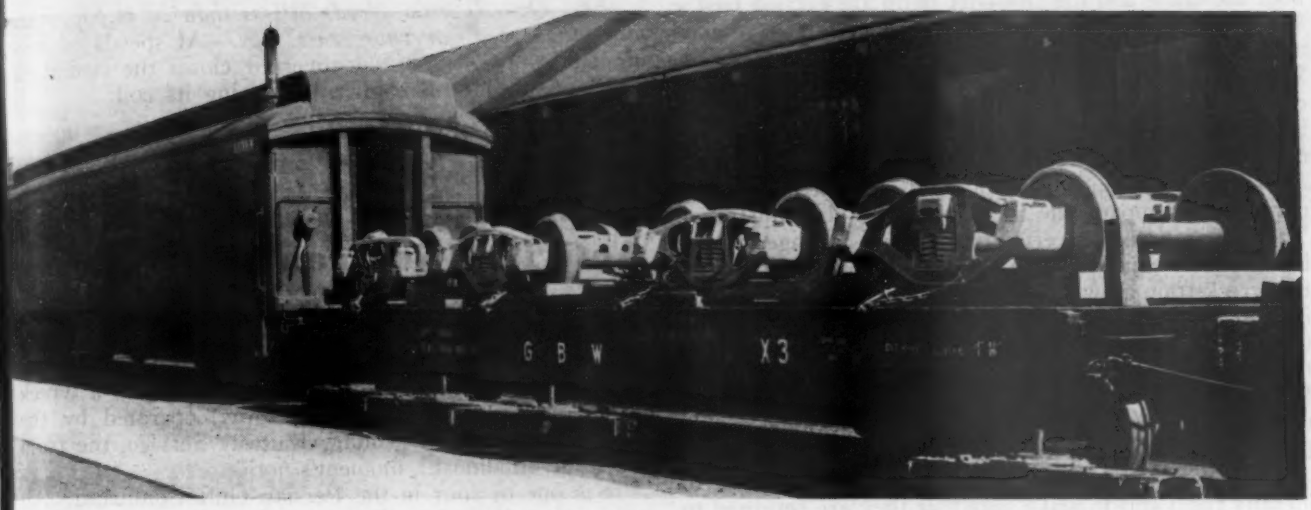
Service cart for load-banding gang

G. B. & W. Crawler Crane Ramp

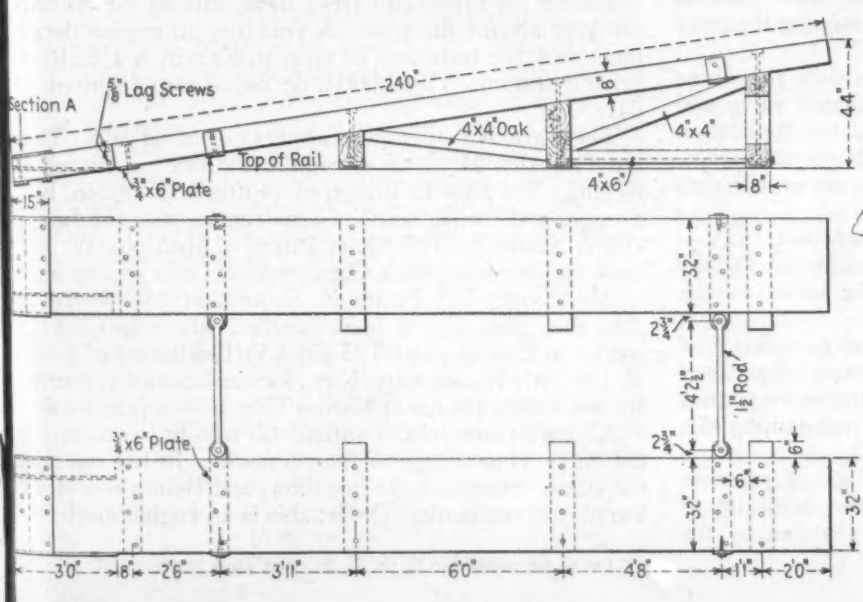
The Northwest crawler crane illustrated is normally carried on a flat car in the Green Bay & Western wreck train with an easily attachable shovel and bucket on an adjoining car. A feature of the equipment is a two-part ramp which the crane itself readily swings into position at the end of the car and then moves down under its own power. This ramp can be placed and the crane moved to the ground ready for operation under normal conditions in 15 min. or less.

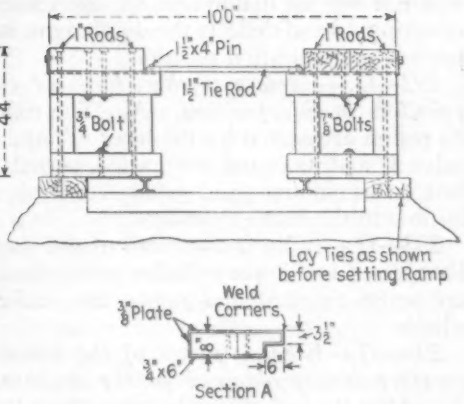
Referring to the drawing, it will be noted that the ramp consists of two built-up sections of well-braced, rigid bolted design, tied together by two 1½-in. steel tie rods. Each ramp section, constructed primarily of 8-in. fir timbers, is 24 ft. long by 32 in. wide. The cross bents and braces are made of oak and the lower end of each part of the ramp is iron clad with a 6-in. cut-out section to hold it in proper alignment with the rail.

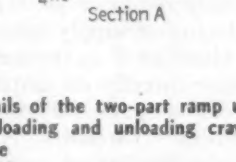
In operation, the two ramp sections are simply swung into place at the end of the car with one side of each resting on the rail and the other blocked as necessary to bring it to rail-top level. The two tie rods are then applied, but no tie between the ramp and the car is necessary, as the crawler crane tends to pull the ramp and car together while either loading or unloading. The fact that



Above: Spare trucks on special flat car—At the left is wreck-train bunk car—Right: Northwest crawler crane with two-part ramp mounted on G. B. & W. flat car







Details of the two-part ramp used for loading and unloading crawler crane

both the crane and the two-part ramp are carried on the same car makes this unit both flexible and self-contained and it can be operated with a minimum of manual labor. The crane itself weighs 80,000 lb. and has a normal rated capacity of 21 tons. It is powered with an internal combustion engine and used primarily for light wrecking operations.

The bunk car and a flat car with spare trucks which normally accompany the wreck train are also illustrated. The bunk car was converted from a mail-baggage car and is completely equipped with the usual accommodations for the wreck-train crew. The 50-ton flat car used for carrying spare trucks has a steel underframe with 3-in. treated-oak decking, provided with wood strips to hold the trucks against transverse movement on the car deck. End blocking is supplemented by chains applied to each truck and secured to side anchor bolts by quick-acting lever clamps and locks.

These trucks are sprayed with a light-colored paint to identify them and to make sure that they are returned to the wreck train after temporary use under other equipment. Other cars used in the wreck train include a blocking car and a tool car.

Air Brake Questions and Answers

HSC Equipment on Passenger Cars and Diesel A and B Locomotive Units Brake Application

291—*Q.—How does the inshot valve portion function in order to move the relay portion to application position?* A.—At the inshot valve portion, application air from passage *16c* flows past supply valve *92* to chamber *C* on diaphragm *85*, thence to passages *15* and *15a*. From passage *15* the flow continues through chokes *138* and *140*, thence past upper magnet valve *161* and *161b* to passages *18* and *19*, passages *18a* and *19a* to the two diaphragm chambers *N* and *P*. When approximately seven pounds pressure is obtained in chamber *C* of the inshot portion, inshot diaphragm *85* is deflected, compressing spring *88* and moving piston *84* sufficiently to permit spring *94a* to seat supply valve *92*, cutting off further flow to diaphragm chambers *N* and *P*. The seven pound initial pressure inshot thus obtained in the diaphragm chambers is directly effective in chamber *P*, where it acts on diaphragm *38*, overcomes the resistance of spring *42* and deflects the diaphragm, moving the relay portion to application position.

292—*Q.—Explain further, how air enters the brake cylinders in this position.* A.—The exhaust valve and its piston are seated by the lever *43*, and the application valve *32* and its piston are opened, permitting main reservoir on locomotives and supply reservoir air on the cars to flow to the brake cylinders.

293—*Q.—What is the result of this movement?* A.—Provides a low brake cylinder pressure sufficient to take up brake rigging, and apply the brake shoes to the wheels.

294—*Q.—What becomes of the seven pounds initial pressure inshot obtained in the diaphragm chambers?* A.—After the inshot supply valve closes the seven pounds pressure in chamber *P* is retained, thus maintaining this inshot pressure directly on diaphragm *38*.

295—*Q.—What polices further build up of pressure in the diaphragm portion?* A.—Further build up of pressure in the diaphragm portion is controlled by the position of the magnet valves.

296—*Q.—At train speeds of less than 20 m.p.h., how does the speed governor react?* A.—At speeds of less than 20 m.p.h. the speed governor closes the circuit to the low speed (*L*) magnet, energizing its coil.

Wreck-Train Activities in Iran*

Arak, Iran—"Home" to T/3 Otis E. Crumm of Chico, Tex., and T/4 Gideon Justice of Grundy, Va., is a railroad car on a wreck train at Arak in faraway Iran.

They live in one of two cabin cars so that, if a wreck occurs on the Iranian State Railway, operated by the U. S. Army's Third Military Railway Service, the train can leave on almost a moment's notice.

It is one of four in the Persian Gulf Command. All are stationed at strategic spots along the 642-mile route of the single-track railroad over which the bulk of more than 5,000,000 tons of war supplies have been moved to the USSR in the last two years.

Sgts. Crumm and Justice keep the 75-ton crane's boilers fired 'round-the-clock, for the derrick is also used in other work, such as in the dismantling and assembly if Diesel locomotive trucks, on the rip tracks in the yards.

A former crane operator at the Ford Motor Company's giant River Rouge plant at Dearborn, Mich., Crumm has been on every wreck train in the command and the Arak train since March, 1943. Justice is a coal miner who learned to be a crane operator at Camp Claiborne, La.

The train consists of two cabin cars, one equipped to sleep eight; a kitchen car, a tool car, a fuel and water tender, the 75-ton derrick, and the block or idle car under the boom. Its territory is from Arak north to Qum, midway point on the ISR's northern division. However, it has aided in clearing the line as far south as Andimeshk and north to Kazvin and above Teheran on the Bandar Shah line.

The wreck crew's biggest job came last September when 27 cars and their cargo left the rails, overturned and burned between Arak and Samagan, ripping up 2,000 ft. of track. Twenty hours were spent in clearing the line.

Recently, the train and its personnel—10 enlisted men and officer go out on calls—assisted the 342d Signal Servive battalion in repairing communications lines blown down in a blizzard in the mountains of Nourabad, at 7,272 ft., the highest point on the railroad.

Except for bread and fresh meat, rations for 30 days are kept aboard the train. A year ago an engine derailment took the train and its crew to Kazvin, a USSR receiving station. The 1,000-mile round trip required 15 days.

There are five others who always go out on calls. They are T/4 Alex M. Shaw of Smithfield, Tex., in charge of rigging; T/4 Otis E. Bolton of (Fifth St.) Corbin, Ky., a rigger and former machinist apprentice with the Louisville & Nashville; T/5 Elmer Profitt of McAlpin, W. Va., hook handler who was a Chesapeake & Ohio section hand at McAlpine; T/5 Frank E. Shoemaker of (Route 1) Andrews, Ind., also a hook handler, who was C. & O. welder at Chicago, and T/5 Fred V. Leadbetter of (3003 N. 13th St.) Kansas City, Kan., former locomotive painter for the Union Pacific at Kansas City, who acts as cook.

All have other jobs. Crumm, 42, who has two sons in the Navy, is in charge of the rip tracks. Justice operates the crane. Shaw is a car inspector, and Bolton is a steam locomotive mechanic. Profitt also is an engine mechanic.

* Passed for publication by the U. S. Army press censor.

Shoemaker is a welder, and Leadbetter is a light repairs trick foreman in the enginehouse.

The other three men are recruited from those available. Either 1st Lt. Robert J. Rush of (Route 1) Westville, Ill., or Capt. Charles F. Gilpin of Rock Springs, Wyo., accompanies the wreck train on its trips. Rush, an enginehouse foreman for the Chicago & Eastern Illinois, has been in Arak since last August. Gilpin, with the Union Pacific for 27 years and mechanical foreman for the Line at Rock Springs, is in charge of the Arak enginehouse. He also is commanding officer of detachments at Arak of the 791st Railway Operating Battalion.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Repairs Billing Limited By Depreciated Value of Car

The Texas & New Orleans and the Southern Pacific have an agreement whereby cars of either ownership may be given heavy repairs in the shops of either company. The Southern sent a damaged Southern Pacific stock car to a Texas & New Orleans shop attaching its defect cards covering accident damage. Later it received a copy of a joint inspection certificate and additional defect cards were requested for items of uncarded damage. The cards were issued and the later billing on their authority amounted to $262.13. Subsequently it was developed that the depreciated value of the car in question, less value of salvage, was $41.35. The Southern, accordingly requested the Texas & New Orleans to furnish counterbilling authority in the amount of $220.78 to adjust the overcharge it claimed on the basis of its interpretation of Paragraph (1b), Section A, Rule 112. The Texas & New Orleans declined to furnish the counterbilling authority as it did not consider that there was any overcharge, basing its contention on the decision in Arbitration Case 1029. The Southern contended that this decision was made obsolete by Item (1-b), Section A of Rule 112, and that a repairing line's bill cannot exceed the depreciated value of the car less value of salvage.

On November 16, 1944, the Arbitration Committee held that, "Paragraph (1-b) of Section A of Rule 112 as modified effective July 1, 1942, abrogated Decision No. 1029. The contention of the Southern Railway is sustained." *Case No. 1804, Southern Railway versus Texas & New Orleans Railroad.*

Billing for Home Movement Repairs

Ten cars belonging to the Shippers' Car Line Corporation were damaged in a derailment on the Texas & New Orleans. After a joint inspection, five of the cars were settled for on the basis of the A. A. R. depreciated value and the remaining five cars were given the necessary repairs to enable them to be moved on their own wheels to shops designated by the owner. Responsibility for the cost of these repairs was the issue in the case. It was the contention of the owner that the repairs made by the railroad were required because the cars had been involved in an accident and that they were of a permanent nature and were, therefore, the responsibility of the railroad. The owner further contended that none of the subsequent repairs made in its contract shops included any of the items covered in the repairs made by the Texas & New Orleans. The railroad contended that defect cards issued by it support its claim that some of the repairs which it made were temporary in nature and others improper repairs. Its action, according to the railroad, was intended as a favor to the owners in returning cars to service as quickly as possible and on saving transportation costs which would have been involved if the damaged cars had been loaded on other cars for shipment to designated shop points. It pointed to certain of the correspondence about these cars as indicating that it had no intention of absorbing the cost of the partial or temporary repairs, which on all five cars exceeded the $50.00 limit set up in Rule 112 governing repairs to damaged equipment to permit moving it to home shops.

In a decision rendered on November 16, 1944, the Arbitration Committee ruled that, "As the total cost of repairs to unfair usage damage did not equal or exceed the depreciated value of car less salvage, under the Interchange Rules the Texas & New Orleans Railroad may charge only for repairs made to owner's defects. *Case No. 1803; Shippers' Car Line Corporation versus Texas & New Orleans Railroad.*

Overload Damage

Missouri Pacific fixed-end gondola car No. 71008 while traveling on a Baltimore & Ohio waybill broke down under load on the New York Central. The car was loaded with steel bars, six bundles to each end of the car with the bundles overlapped in the center. The total load was within the load limit capacity of the car but there was a question as to whether an undue concentration of weight occurred at the point where the bundles were lapped. The case was first submitted to the joint committees, Car Construction and Loading Rules and it was agreed that the wording of Loading Rule 4 was not clear and that certain modification and clarification was needed in the reading of Section B. No agreement could be reached by the parties as to the proper interpretation of Loading Rule 4 and responsibility under Interchange Rule 32, Paragraph (10-h), and the case was submitted to arbitration. It was the contention of the Baltimore & Ohio that the car was loaded in accordance with provisions of the existing loading rule. The New York Central pointed out that the method of loading created a concentration of load at the lapped section bearing pieces which exceed the 40 per cent permissible load concentration provided for in Loading Rule 4 for a distance of 10 ft. long or less. It asked for offset protection on the defect card which it had issued and payment to itself for the cost of transferring the load.

The Arbitration Committee decided on November 16, 1944, that, "Loading Rule No. 4 prohibits loading in excess of 40 per cent of the stenciled load weight limit over a space of 10 feet or less in fixed-end gondola cars. MP car 71008 was loaded to 48 per cent of the stenciled load weight limit over a 7-ft. bearing-piece spread Therefore, the car was overloaded. This opinion has the concurrence of the Committee on Loading Rules. The damage is the responsibility of the originating road haul carrier, as provided in Rule 32, Paragraph (10-h). The contention of the New York Central Railroad is sustained." *Case No. 1805, New York Central Railroad versus Baltimore & Ohio Railroad.*

ELECTRICAL SECTION

Year of Train Telephone Tests

The conductor talks to the engineman

By W. W. Pulham*

Rio Grande reports on results obtained with different types of equipment operating under wide variety of conditions

To the uninitiated radio communication between the engine and the caboose on freight trains might seem a relatively simple facility to install. The Rio Grande, however, after testing and experimenting for a year, has found and is now coping with many problems which must be overcome before we can have 100 per cent communication between the engineer and the conductor, and at the same time not interfere with other proposed radio services. Some of the problems presented are the result of difficult terrain over which our railroad operates between Denver, Colo., and Salt Lake City, Utah.

There are 50 tunnels in the 570 miles of main track between these two terminals, ranging in length from 100 ft. to 6.2 miles (Moffat tunnel). Thirty of these tunnels fall within 35 miles, on part of the 129-mile stretch where the Rio Grande operates over the Denver & Salt Lake trackage on the Dotsero cut-off route. In addition to these obstacles to communication, there are cuts, winding canyons, and extremely rugged terrain. On the other hand, between Grand Junction, Colo., and Helper, Utah, the railroad passes through relatively flat, open country.

One of our biggest problems becomes that of having sufficient power to overcome extreme attenuation in the mountainous country, and at the same time not so much power that too great a distance is covered in open country, which would tend to create a congestion of air traffic and consequent interference with other proposed services.

* Superintendent of Communications, Denver & Rio Grande Western, Denver, Colo.

Started Test in April, 1944

We made our first test run early in April, 1944. At that time, police emergency radio equipment was used, operating in the 30-40 mc band, frequency modulated, and with a power output of 60 watts. The installation was made on a fast-freight train of 65 cars out of Denver, and increased to 85 at Grand Junction. It was estimated by the train crews that the time saved in closing switches, stopping to cut out a bad-order car, release of sticking brakes observed by the rear end, highballs from the rear, and over-all operating handled by radio, amounted to approximately three hours from Denver to Salt Lake. Communication was maintained continuously with the exception of within the Moffat tunnel and in two of the longest minor tunnels. Several problems were disclosed, however, that would have to be solved before we were ready for regular installation. In the first place, it was improbable that the F.C.C. would be able to give us a license in the 30-40 mc channel. We had reason to believe that the power was too great for open country work, and we failed to obtain communication through all the tunnels. Another major problem was

Transmitter and receiver as installed in a caboose

East portal of the 6.2-mile Moffat tunnel

that of supplying cabooses with suitable and adequate power for the operation of the radio equipment.

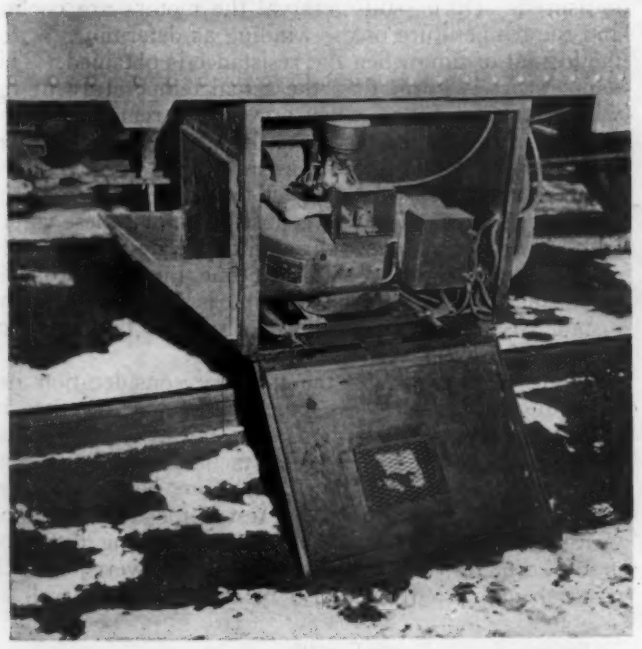
Various Other Tests Made

Since that time, many test runs have been made with a number of different types of equipment, to determine what type of modulation, transmitter power, type of antenna and radiation, receiver sensitivity, and frequency would be best suited to do a satisfactory communication job from engine to caboose.

We have used amplitude modulation, frequency modulation and phase modulation; we have operated in the 30-40, 117, 156 and 2,700 mc bands; we have used power ranging from 6 watts to 60; and have experimented with a number of antenna types from a simple ¼ wave-to-ground to intricate arrays. In addition, we have studied various types of power supplies for the cabooses.

It is interesting to note that in only one test have we successfully obtained communication through the Moffat tunnel. This was done with 15-watt phase modulation equipment operating in the 2,700 mc band. A multiple driven antenna array was used which gave us a low radiation pattern 360 degrees in extent. It is believed that the tunnel acted as a wave guide in this instance, which resulted in a stronger signal being received inside the tunnel than in open country transmissions. This performance would indicate a promising future for this frequency, but at the present time this type of equipment has not been developed on a commercial basis.

A decision between the use of AM and FM has become a problem. Both types are free from man-made static in the very high frequency range. The use of FM tends to give one station preference over a station somewhat further away from the receiving station, thus blocking out the latter. This is not true with AM, and there is a question whether this would be advantageous or not.



A gasoline-driven, 117-volt, a.c. generator mounted under the caboose

Mountain canyons along the Colorado River impose special problems

Engineman using a close-talking microphone employed with Galvin-Motorola tests made in March and April, 1945

Our studies have indicated that a radiating power of not over 25 watts combined with a high-gain receiver should be adequate for our mainline end-to-end service. A number of types of antennas do a very satisfactory job, especially those that are non-directional and radiate at a low angle. It is believed, however, that still more improvement can be made along this line, and we are continuing with our experiments in antenna design.

(*Continued on page 317*)

Temperature Governs Tonnage*

By J. W. Teker†

Method for obtaining full output of Diesel-electric locomotives without risking damage to insulation by cut-and-try methods

THE Diesel-electric locomotive does not know when to quit, nevertheless its ability to handle overloads is dependent upon the thermal capacity of the electrical apparatus so that the duration, for which a given overload may be maintained with safety, is determined by the temperature of the windings preceding its application. Where ruling grades, or speed of operation limit train weights, the load is generally below the continuous rating of the equipment so that low winding temperatures provide a useful margin of overload capacity. This is an advantageous attribute of the electric drive in railway operation when correctly utilized.

It is essential to know motor temperatures just preceding a given overload to be able to determine the permissible duration for such duty. Temperature measurements taken in the intended service will be a check on the assumptions made during application study. It is often hard to make proper assumptions of variables when making such studies for a difficult service. When steam helpers are required to move heavy trains over long grades, it is necessary at times to reduce Diesel-engine speed and power input to the motors in order to accommodate differences between the speed-tractive force characteristics of the steam and Diesel locomotives. If traction motor blowers are belt driven, the volume of ventilating air is then decreased so that even operation at the continuous rating may be questioned. Temperature measurements are useful to obtain data and checks on such operation.

Cut-and-try overload application methods in service on narrow margins without knowledge of apparatus temperature is an uncertain undertaking the inadequacy of which may not be immediately evident, but will show up in time by increased maintenance cost and frequent motor or generator failures. Severe overheating in a single instance may be sufficient to shrink wedges and relax bands, without causing immediate failure, but subsequent movement of the winding under influence of vibration will cause the insulation to wear through and fail by short circuit or ground even before complete deterioration of insulation is achieved.

Various means have been developed in the past to give a continual indication of motor temperature, but none has been favored by general use. Until such time as reliable temperature-indicating instruments are developed for railway use as to warrant general application, the measure of motor temperatures by the resistance method is the most reliable and accurate means available today. It is a recognized and familiar means of temperature determination by electrical apparatus manufacturers and is common on their test floors where the personnel is trained and skilled in its use.

This same method has been developed for the railway field by a series of evolutionary experiences until the technique and required skill have been reduced to a point where measurements can be made under these adverse conditions by an operator and the help of men unskilled in laboratory or test-floor methods. The results equal and sometimes surpass in speed, accuracy, and uniformity those obtained under more favorable conditions on the test floor, and it becomes a practical tool for general field use where questions pertaining to motor temperatures have a bearing on railway operation.

The method selected for determination of average motor-winding temperature is dependent upon the known change in electrical resistance of a copper conductor with temperature, and is expressed by the relation $T - (R/r)(234.5 + t) - 234.5$. The initial, or cold resistance, r of each component winding in question is measured after the motors have stood without power long enough to allow all motor parts to cool to a uniform ambient temperature, t, which is measured directly with mercury thermometers placed upon the motor parts and checked with each other and surrounding ambient temperature. The hot winding resistance, R, is measured at prearranged stops on the main line with the train and at the point where the temperature of the motors in the actual service is questioned. The temperature, T, is then readily evaluated from the corresponding cold resistance, r, at temperature t.

It is necessary to remove power from the motors and bring the train to a stop before these resistances can be measured. During this interval the motors are cooling and the temperature of the winding as determined is for the instant of time when the resistance is obtained. This temperature is lower than the actual temperature of the winding at the instant when power was removed by the amount of cooling taking place during this elapsed time. However, by continuing to measure the resistance of the winding as it cools with respect to a time started at the instant of power removal, it is possible to plot these values and draw a cooling curve through the related points. By extending this curve back to zero time, the most probable actual temperature of each winding is determined at the instant of power off, and is well within the limits of accuracy for all practical purposes.††

While temperature is the primary consideration determining motor life, it is expedient to plot the data in terms of temperature rise so that performance can be compared between successive tests under different conditions. Measurements must, therefore, be made of the ambient temperature during the test of the traction-motor ventilating air, as well as the air surrounding the locomotive. The volume of ventilating air delivered to each motor being tested must also be determined as well as

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* Abstract of a paper recommended for publication by the Committee on Land-Transportation, American Institute of Electrical Engineers appearing in the July issue of Electrical Engineering.

† Engineer, General Electric Company.

†† American Institute of Electrical Engineers Standards ASAC 35.1—1943, 11-156, 158 and 159.

the power input to the motors so that rms current values can be calculated for the train tonnages hauled.

The success of the method outlined is dependent upon practical means for making the necessary measurements and upon a test crew organized and equipped to make these measurements without causing serious loss of time to the scheduled run of the train.

The motor-field windings are connected to the instrument with temporary wiring and suitable switches so that resistance measurements can be made quickly. The instrument station should be located in the cab as close to the motors as possible so as to hold length of the interconnecting leads to a minimum.

The armature resistance is obtained by selecting a span of the armature winding to which connection is made by contacts spaced apart by the desired number of commutator segments and held in fixed relationship by a special yoke applied by hand pressure to the commutator through the motor-inspection opening

Connection between contacts of the yoke and the instrument station is made through a multiple-wire flexible cable long enough to reach through a cab window down to the motors in the locomotive truck. This equipment is coiled and carried in the cab between stopping points for measurements.

Communication System

A signal system is necessary between the man at the instrument station and the man in position at the motors when measurements are in progress because of their remote location and the magnitude of noise level with Diesel engines idling. A push button fixed at the instrument station and a simple electric bell properly protected against injury during handling is used for this purpose, interconnected with flexible leads long enough so that it can be lowered from the cab to a man on the road bed. The signal code used is as follows:

One bell—make contact with yoke on armature.

Two bells—hold contact; measurement is in progress.

Three bells—remove contact.

An ammeter placed in the battery circuit of the bridge indicates as soon as a circuit is established through the armature and informs the resistance-bridge operator to proceed with measurement, while the man making the contact is informed to hold it by signaling two bells. A failure to establish contact with all four points on the commutator simultaneously is evidenced by failure of the ammeter to indicate if the current circuit is open or by an off-scale swing of the bridge if the voltage or drop circuit is open. In this case, the operator continues to call for contact by repeating the one-bell signal.

Commutator temperatures are measured with a contact type hand pyrometer. This is an open junction thermocouple instrument with inherent ambient compensated millivoltmeter reading directly in degrees centigrade.

Thermocouples made up from copper and copnic wire serve to measure the temperatures at remote locations inaccessible while under way, such as the roof and roadbed ambient temperature, traction-motor armature and axle bearing, frame, and air-out temperatures.

Power Input Measurement

The power input to the motors is measured with a voltmeter and ammeter with respect to time; the interval

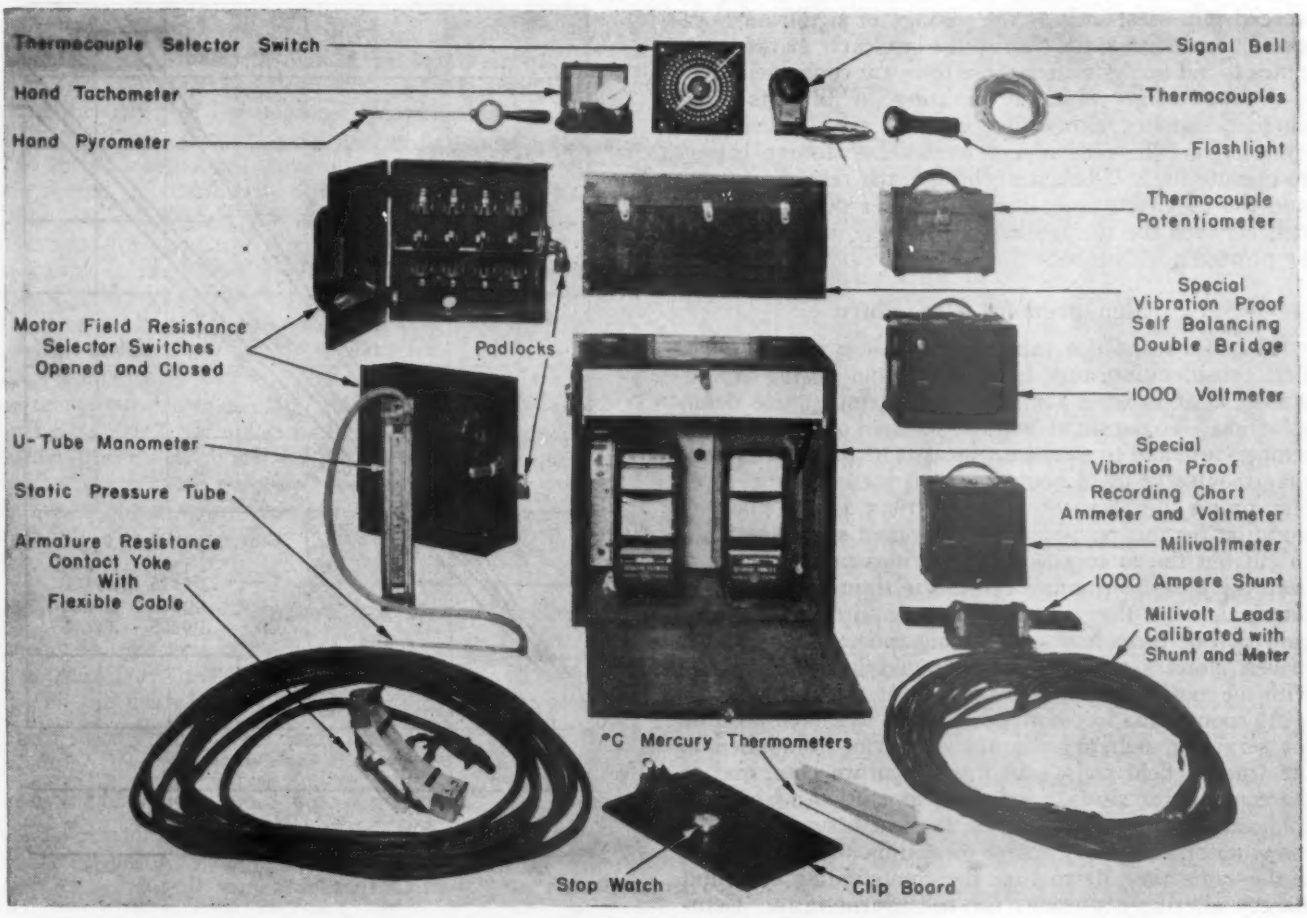


Fig. 1—Instruments and special equipment required for measurement of railway motor temperatures in service

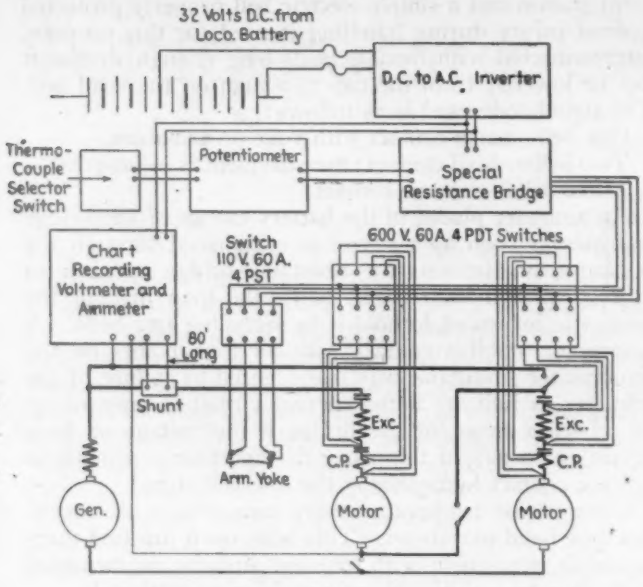


Fig. 2—Connection diagram for measurement equipment

of which is dependent upon the profile of the railroad and the operation being studied. This is a laborious and tedious procedure which may be eliminated by installing chart-recording instruments to keep a graphic record of the test. Recording meters should be equipped with special marker pens, energized periodically by means of a telechron-driven contact-making switch to put a reference mark in each graph. A push button should also be provided to permit operating the marker pens at will for special purposes, such as the passage of significant locations. In addition, the chart must be clearly marked with notes to aid analysis after these tests are completed.

A small rotary inverter operating on 32 volts direct current supplies alternating current at 110 volts, 60 cycles, from 16 cells of the locomotive storage battery to operate the self-balancing bridge, the recording meter and the telechron timer for the marker pens. The circuit between the storage battery and the inverter should be protected with fuses.

Measurement Procedure

The cold-resistance value of the motor windings is a first consideration after instruments and wiring are installed as it is basis for subsequent temperature determination. To permit all windings to cool off to a uniform temperature and to equalize with that of the entire motor may require 12 to 24 hours and will present a real problem unless the layover between runs is of sufficient duration for this purpose. Arrangement should be made to cut out the motors selected for measurement and to keep the blowers running before the train arrives at the terminal, when they are no longer required. This may gain two or three hours of cooling time. If electrically driven blowers are used, they should be kept running with the motors or power plant cut out.

As soon as the locomotive is spotted in a final position for servicing, mercury thermometers can be applied to the frames, field coils, pole tips, armature core, and to the commutator risers. It is well to caution against the application of putty directly on the brush surface of the commutator as it may present some difficulty in cleaning, at the same time destroying the commutating film and thereby altering conditions for subsequent tests. Comparative ambient temperature may be obtained by placing a thermometer on the track rail head with putty over the bulb, or by placing a thermometer in a small can filled with oil so as to stabilize fluctuation in air temperature when large doors are opened in the locomotive service shop or enginehouse, or with variable wind if standing in a railroad yard. Cold-resistance measurements can be started as soon as comparative observations of thermometers show reasonable agreement. Record the date, time, temperatures, with resistance values, and check at intervals.

When measuring armature cold resistance, the armature yoke should be applied on several alternative segment positions available and, after removing the armature thermometers, the locomotive may be moved sufficiently to present different sections of the commutator, the measurements on which should check reasonably with one another.

Cold-resistance readings should be again measured at the conclusion of all testing and checked with the initial readings to ascertain that no changes had occurred during the testing period. For this purpose, resistance values should be evaluated at 25 deg. C. as a ocmmon basic temperature for comparison.

The work of reading temperatures will be greatly facilitated by drawing temperature resistance curves for each winding in each motor being tested (Fig. 3). Since this curve is a straight line within the range of temperatures under consideration, it is only required to plot the cold-resistance values at their measured temperature and calculate the value of resistance for 200 deg. C. as being the extreme value when hot. A straight line is drawn through these two points and any intermediate value can be read directly from the curve.

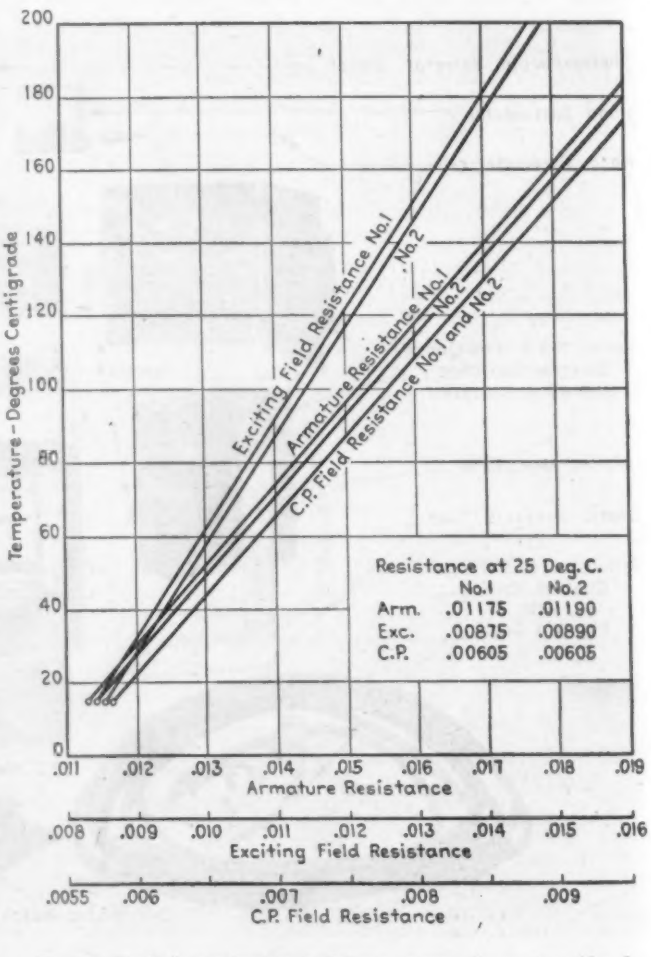
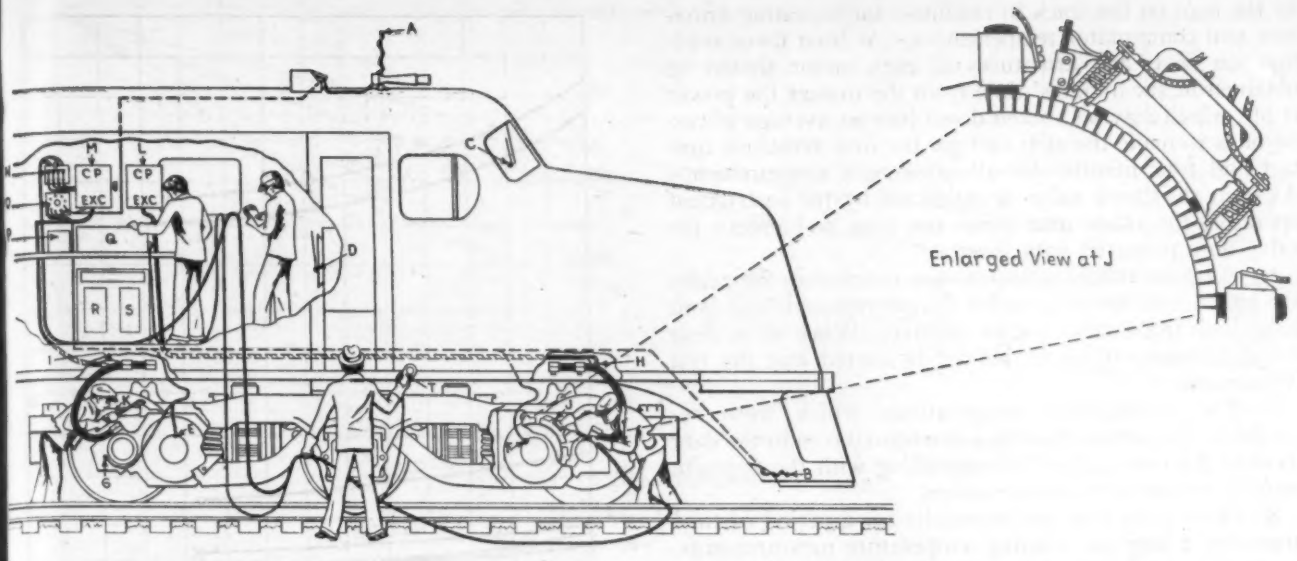


Fig. 3—Typical temperature-resistance curves for motors No. 1 and No. 2



A—Roof air temperature T.C.
B—Road-bed air temperature T.C.
C—Windshield air thermo
D—Traction motor blower air in thermo
E—P.E. armature-bearing temperature T.C.
F—C.E. armature-bearing temperature T.C.
G—Axle-bearing temperature T.C.
H1No. 1 motor field resistance leads
I—No. 2 motor field resistance leads
J—Armature resistance yoke
K—Commutator temperature pyrometer
L—No. 1 motor field resistance selector SW
M—No. 2 motor field resistance selector SW
N—Armature resistance switch
O—Thermocouple selector SW
P—Thermocouple potentiometer
Q—Vibration-proof double bridge
R—Recording voltmeter
S—Recording ammeter
T—Signal bell

Fig. 4—Position of personnel when taking temperature measurements

The air delivered to the motors by the blower is best measured by drilling the commutator inspection cover to admit a static pressure tube into the commutator chamber; then read the air pressure in inches of water on a manometer. The readings should be taken at idling, one-half and full speed of the blower. At the same time measure the speed of the engine. When tests are concluded, engine and blower speed should again be measured to see that conditions remained the same during the testing period. Record date, time, speed, temperature of air at blower intake, and barometric pressure, if the date is to be used for comparative reference.

A similar procedure for electrically driven blowers should be followed except that speed would be dependent upon blower voltage instead of engine speed as with the belt-driven blower.

The volume of air to the motors is determined from a pressure-volume curve usually available for the type of motor being tested. If not available, one can be prepared by blowing a similar motor through a calibrated pipe to determine the volume delivered for corresponding pressures in the commutator chamber as outlined by blower manufacturer's testing code.

Making the Service-Temperature Measurements

Before the test run is made the locomotive should be moved from over the service pit onto a section of track similar to the main-line road bed. Assign the test crew to their stations and outline the testing procedure and the duties for each station. The entire sequence of the test should next be rehearsed, including the making of measurements, and the entire operation timed from start to finish. This practice will prove invaluable to the men by relieving tension and instilling confidence and teamwork in preparation for the actual measurements on the main line.

The following program of events is performed in sequence (Fig. 4):

1—Just preceding the arrival at the designated stop for heating measurements, a prearranged signal from the head end is given when power is no longer required to make the stopping point. Padlocks are removed from the switches, and all equipment is made ready.

2—As soon as power is shut off at the head end and the engines come to idling speed, a stop watch is started at the instrument station, and the electric-driven blower or the Diesel engine belted to the blower, as the case may be, is shut down completely.

3—As soon as the train comes to a stop it is made safe (removal of reverser handle or other means to lock power off) by a man at the head end who then leaves the cab and takes a position on the road bed at the truck while two other men, one for each motor, climb under the locomotive and remove the motor-inspection covers.

4—While part 3 is taking place, the two men at the instrument station unwind cables and pass the armature yoke, signal bell, and pyrometer down to the man on the road bed adjacent to the truck, who retains the bell and gives one man at the motors the resistance yoke and the other the pyrometer.

5—Resistance measurements are made in the following order by two men at the instrument station: (a) Motor No. 1 commutating field, then exciting field, followed by the field measurements on motor No. 2.

(b) Signal for armature contact to be made and held on No. 1 armature while No. 2 commutator temperature is measured. Signal as soon as resistance is obtained and the man on the road bed will pass the yoke from No. 1 motor to No. 2 and the pyrometer from No. 2 to No. 1 and make a record of commutator temperature. As soon as contact is established on No. 2 armature, the instrument station will acknowledge by signal to hold contact while resistance is measured, after which the concluding signal is given. Meanwhile record is made of No. 1 commutator temperature.

(c) The fields of motors No. 1 and No. 2 are again measured while the yoke and pryometer are exchanged

by the man on the track in readiness for repeating armature and commutator temperatures. At least three readings on fields and armatures of each motor should be obtained in six minutes' time from the instant the power is off, which may be broken down into an average of two minutes to make the stop and get the first armature contact and four minutes for all subsequent measurements. As each resistance value is called off by the instrument operator, the other man notes the time and enters the value on a prepared data sheet.

6—As soon as measurements are concluded, the cables are pulled into the cab, motor covers replaced, and both men climb from under the locomotive. When all is clear the shut-down engine or blower is started and the run is resumed.

7—The commutator temperatures which were recorded by the men on the track are transferred to the data sheet at the time values corresponding with the opposite motor's armature-resistance values.

8—During the run, and especially for a period of time preceding a stop for winding-temperature measurements, readings are taken and recorded in the log of air temperature on the roof, road bed and at traction-motor blower intake. Readings are also made periodically of motor frame, air out and bearing temperatures. The chart recording meters are inspected to see if they are inking and calibration is checked with readings on the indicating meters. At the head end of the locomotive, windshield temperature, speed, location on the railroad, and controller-notch position are recorded with respect to time so that it may be related with the readings in the test log.

For the purpose of obtaining these readings, the test crew is reassigned to secondary duties so as to have a division of labor but insuring coordination of all data at one point. The train consist in tons and number of cars for each test run should be recorded with the train identification and direction of travel.

Determination of Operating Temperature

The resistance value can be read off directly as temperature from the resistance-temperature curve and, by subtracting the motor blower air-in temperature, the rise of the winding is obtained, corresponding with the time of measurement. These values of rise are plotted with respect to time and a smooth exponential curve is drawn through related points to zero time and the intercept with the temperature axis is the most probable temperature rise of the corresponding winding at the instant of power removal (Fig. 5). The importance of getting the first readings as soon as possible after power off becomes evident, for it minimizes the extent of extrapolation of the curve.

The cooling-curve technique is also applied to the hand pyrometer commutator temperature readings to arrive at the probable rise just before power off.

Occasionally, circumstances will prevent immediate measurement of armature resistance and a prolonged cooling period will result before the first reading is obtained. The extrapolation of these delayed data to zero time is aided by the use of average armature cooling curves (Fig. 6). These curves are prepared from factory test data on the same type of motor for several different conditions of power input, and are expressed in terms of per cent temperature rise with respect to time. Generally, heavy loads of short duration have steeper cooling-curve shapes than continuous runs. This is caused by the steep temperature gradient between the copper and the iron core which lags behind during the short heating-up period, whereas

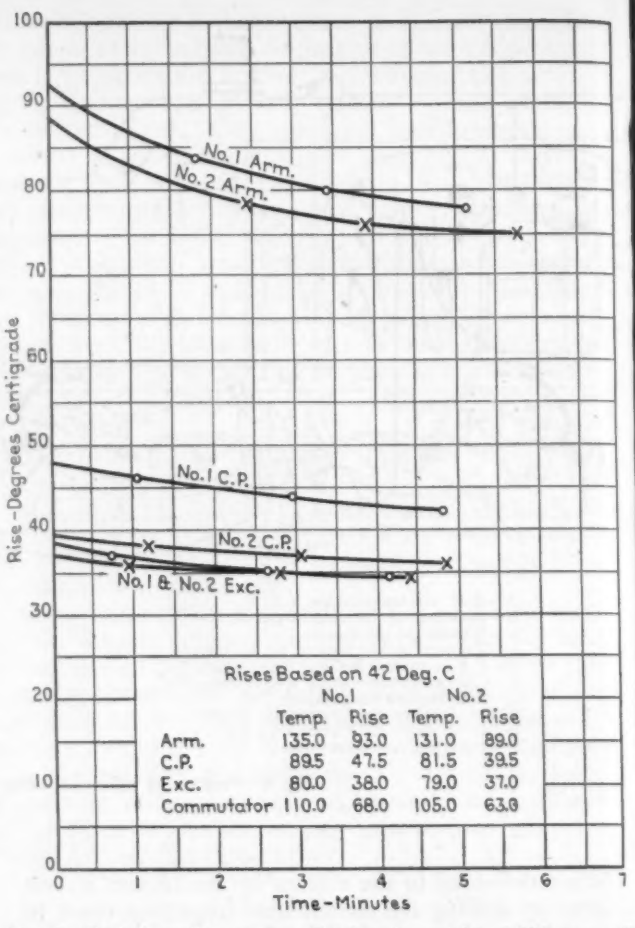


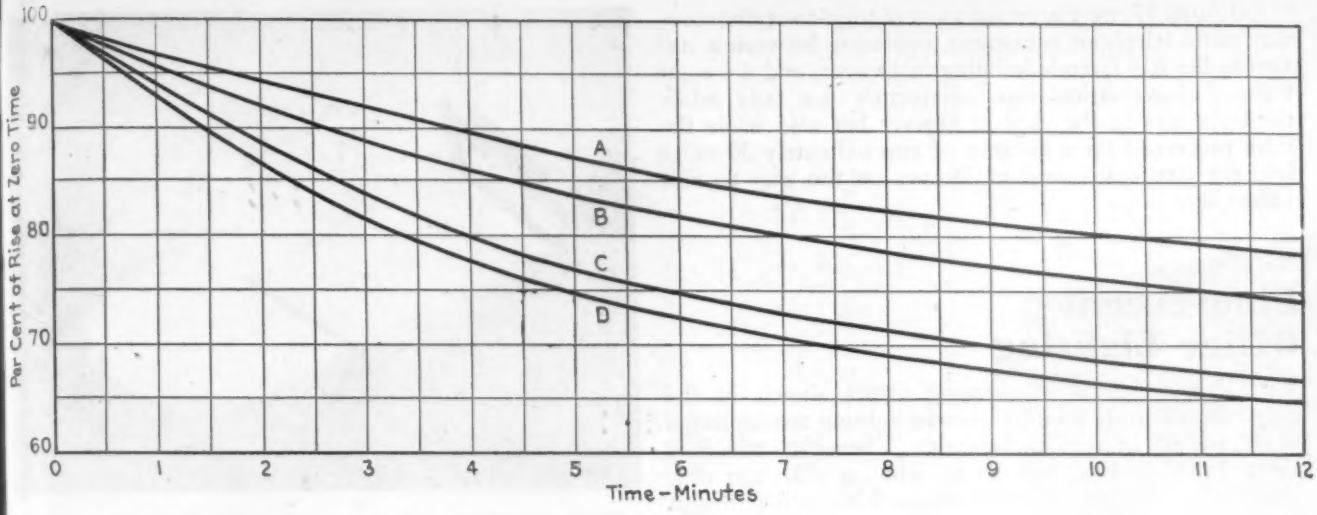
Fig. 5—Typical cooling curves—Total train weight, 1,224 tons (13 cars plus locomotive), rms current, 449 amp. for 67 min. or total distance of 81 miles

during a continuous run their temperature becomes more nearly equalized.

The proper cooling shape is selected by evaluating the power input for the period preceding the shut down in service and identifying it with a corresponding curve shape, or by interpolating between the two curves coming closest. From this curve is read, for the elapsed cooling time at which the first service reading was taken, the percentage value of the actual measured temperature rise, from which is prorated the 100 per cent value at zero time.

The rms (root-mean-square) current value is obtained from the chart made by the recording ammeter by dividing the graph into intervals of time, and the average current value for each interval is squared and multiplied by that time interval. The sum of these products is divided by the total time to get the average current squared for the run. The square root of this value is the rms current value for the test.

It is not always practical to obtain the full desired train tonnage without delaying the test, or during the test run it may be desired to check performance with one power plant hypothetically broken down. These situations can be approximated by purposely reducing the locomotive power by multiples of the number of motors until the desired prorated train tons per motor is obtained. The temperature measurements are then made under this artificial condition. For example, if two out of eight motors are cut out, of a locomotive in an 18-car test train having a combined weight of 1,680 tons, the load per motor will be increased from 210 to 280 tons. The heating of the motors would then be equivalent to that of a 24-car train of 2,240 tons total weight.



	Amperes	Revolutions per min.	
A—	650	1,300	Continuous
B—	675	778	Continuous
C—1,000		450	30 min.
D—1,130		374	13 min.

Fig. 6—Average armature-cooling curves obtained from heat-run data

The method, procedure, and equipment are also applicable to measurements of generator temperature which can be made in a multiple-unit locomotive by shutting down the one power plant for a few minutes to obtain measurements without the necessity of stopping the train.

The recording-chart instrument with calibrated meters affords data on engine horsepower output by reference to a generator characteristic for the generator efficiency values over the operating range from which the horsepower input to the generator can be calculated.

Temperature of locomotive electrical apparatus is more than a question for academic consideration; it is an active economic factor, never at rest and continually exerting its influence with time on the life of the equipment. The penalties of rash application or abusive operation are inescapable.

The effect of elevated temperatures on organic insulation materials follows the approximate rule of half the life for each 8-12 deg. C. increase in temperature.* The indisputable and direct approach to correct utilization or application of motive power is with a full knowledge of electrical apparatus temperature. The testing facilities and method outlined provide these necessary data for railroad operating and motive-power departments, as well as engineering information of application and design value. It is a means whereby a railroad can take the measure of its tough spots and the engineer correct his shots.

* Report No. 1A, September, 1941, "Report on General Principles for Rating of Electrical Apparatus for Short-time, Intermittent, or Varying Duty."

Year of Train Telephone Tests

(*Continued from page 311*)

The problem of power for cabooses has proved to be an interesting one, and there are two schools of thought on the subject. One favors the axle-driven generator type, similar to that used on passenger cars, except on a smaller scale. The other believes the internal combustion engine-driven generator to be the better of the two types of power. We are studying both kinds of power from the standpoint of initial cost, maintenance cost, out-of-service time, dependability, and amortization time. For the benefit of those who are skeptical of the engine-driven power, we can certainly commit ourselves to the extent that performance is very satisfactory and relatively trouble-free. We have operated one unit for more than 500 hours with one spark plug failure being the only trouble encountered. Inasmuch as the engine is a two-cylinder horizontally opposed type, the remaining cylinder continued to operate the generator for five hours until a terminal was reached, and no power failure resulted. Communication was maintained with no apparent loss of power.

Studies also are well under way on the Rio Grande

Type of two half-wave, in-phase antennae used for the Galvin-Motorola tests

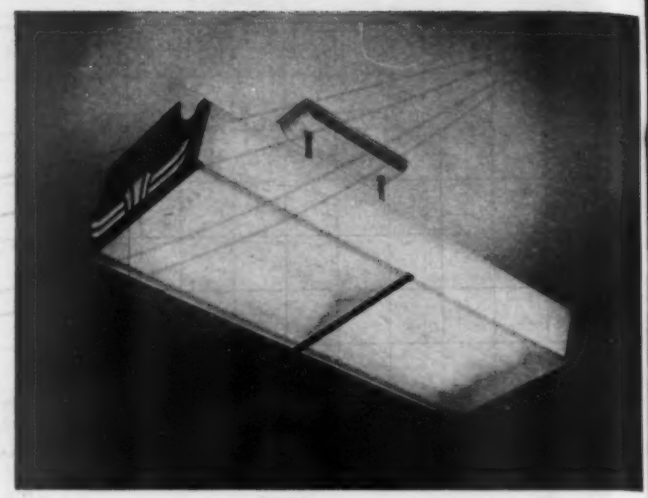
for train-to-station communication by radio. It is planned to operate from fixed stations with an antenna in the most advantageous point as practical, with remote control, if necessary, to the operations office. In open country this should be relatively simple. In the mountainous area, it is anticipated we will probably find that numerous relay stations will be required to carry the communique the required distance from trains to the station.

On April 17, we conducted a test of train-to-station two-way radio telephone equipment, operating between a station in the Rio Grande building in Denver, and a freight train. Conversation was satisfactory not only while the train was in the yard at Denver but also while the train proceeded for a distance of approximately 30 miles into the mountains west of Denver on the way to Salt Lake City.

Fluorescent Office Lighting

The Jersey Central Accounting Office shown in the illustration affords good fluorescent lighting accomplished by means of individual fixtures. The office which is about 1,000 ft. long and 50 ft. wide, a year ago consisted of a number of small offices with ceiling height partitions on either side of a central corridor, lighted with a miscellaneous assortment of 200-watt incandescent fixtures. At that time, the partitions were removed and the new lighting system installed. A second office in the same building which is about 300 ft. shorter than the one shown, is similarly lighted.

The fixtures are Mitchell Manufacturing Company. U. R. C. units, consisting of metal frames and corrugated glass panels, each containing four 40-watt 3,500- deg. F, white, fluorescent lamps with two-lamp auxiliaries. Each unit has a fixture switch operated by a pendant cord. The lighting units are four feet long and 18 inches wide. They are placed on 14 ft. centers longitudinally and 10 ft. centers laterally, making the distance from edge to edge between fixtures approximately 10 ft. The mounting height is 9 ft. from the floor to the bottom of the fixture.



A close-up of one of the fixtures used in the office, shown in the other illustration

Ceilings are finished a flat white and the side walls a flat light green, with darker green trim. Lighting intensity on a horizontal plane, 30 in. above the floor, as installed was 30 foot-candles with almost no measurable variation.

There are four units on each circuit and the minimum wire size is No. 12. Distribution of individual circuits is made from Bulldog deadfront safety panels, with a single Buss Fustat in each circuit. These fix the size of fuses which can be applied. In this case, 15-amp. fuses are used on each four-fixture circuit. There are a total of 225 units in the two offices which are located respectively on the second and third floor of the Express building.

Fluorescent-lighted office of the Jersey Central located in Jersey City, N. J.

(Turn to next left-hand page)

AMCCW membership gives you an assurance like that of a famous trademark

WHEN you learn that a wheel manufacturer is a member of the Association of Manufacturers of Chilled Car Wheels, you can feel the kind of assurance that a famous trademark gives you when you make an important purchase.

Here is why. To retain good Association standing, every member manufacturer must adhere to a specific and carefully worked out code of wheel manufacturing practice. Chill block tests, chemical analyses, processing temperature checks, drop tests, thermal tests, rotundity tests and hardness tests — all these precautions are not mere recommendations but required conditions of membership.

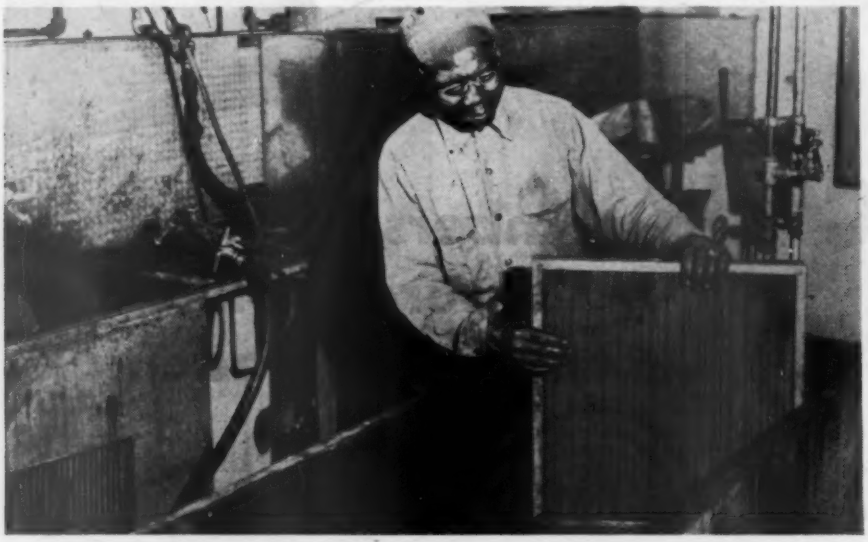
These high metallurgical and manufacturing standards are designed to protect quality, to protect the *purchaser of quality,* to help our railroads in continuing their outstanding wartime achievements.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

NEW DEVICES

Air Filter Cleaner

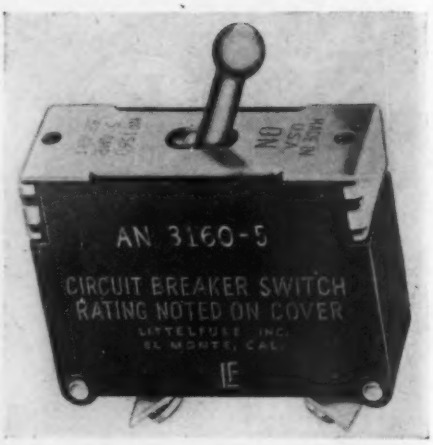
A process for the chemical cleaning of all types of air filters, including air conditioning and engine filters has been developed in the laboratories of Turco Products, Inc., of 6135 South Central Avenue, Los Angeles 1, Calif. The process eliminates the necessity of using distillate or other materials which may leave an offensive odor or are a fire hazard. It also shortens the time required for the complete operation. The procedure is to immerse a filter for six minutes in a tank of cold Turco Aktiv, mixed in the proportion of four ounces to a gallon of water. The filter is removed from the dipping tank and given a cold water hosing to flush away dirt and grease; then dried in a stream of compressed air, and dipped into the manufacturer's specified oil. According to time-studies the entire process takes under thirteen minutes. Required equipment is simple and no skilled labor is necessary.



Air filter being removed from cleaning tank

Switch Breaker

A circuit breaker relatively free from the effects of extreme high and low temperatures is announced by Littelfuse Inc., Chicago. The actual trip temperature of the breaker without flow of current is 350 deg. F., ambient temperature. The bi-metal which responds to temperature is used as the finger that pulls the trigger. No appreciable mechanical load is exerted on the bi-metal as it trips the breaker. Its high time lag adapts it to protection of motors and other equipment having high starting surge currents. The capacity range is 5 to 50 amp. at 32 volts a. c. or d. c. It is capable of breaking 2,500 amp. on short circuit. It meets the requirements of holding for one hour at 115 per cent of rated current; breaks within the hour on 138 per cent of rated current; breaks at 200 per cent of its load between 10 and 100 seconds. These tests are all at the ambient temperature of 77 deg. F. + 1.8 deg. F.



The breaker is affected little by high ambient temperatures and is suitable for motors requiring high starting surge currents

Draft Gear Speed Hoist

The Malabar Machine Company, Los Angeles, Calif., is manufacturing a fast-acting, hydraulically operated hoist to expedite the removal and installation of draft gears, drawbars and yokes in passenger and freight cars. It is also designed to pull "frozen" draft gears down from the carrier by looping a chain around the draft gear and the table of the hoist. For this purpose it exerts a pull of three tons. It has a lifting capacity of five tons.

On the hoist table, which is constantly in a horizontal position, there are movable fingers which can be adapted to hold the draft gear, drawbar and yoke The unit is mounted on ball-bearing swivel casters for portability and easy spotting under cars.

Motor Attachments For Duff-Norton Jacks

Manually operated jacks can be converted for motor operation by means of Duff-Norton motor attachments, according to the Duff-Norton Manufacturing Company, Pittsburgh 30, Pa. The attachments are made in two types, Duff and Norton. Both types are quickly and easily attached, making possible the use of portable shop motors of 1½-in. to 2-in. drill size to power jacks for lifting, lowering, pushing or pulling. The No. 4085 Duff attachment is designed for use with Duff-Norton governor-controlled jacks, and may be attached or removed as desired. The No. 4086 is a permanent model, and is bolted to the jack.

The Norton motor attachment, No. 571-MA, is used with Duff-Norton self-lowering speed-controlled jacks, and is quickly slipped on the jack pinion shaft after removal of the ratchet case and gear.

Hydraulic hoist for applying and removing draft gears

(*Turn to next left-hand page*)

THE VIRGINIAN RAILWAY

places in service

a fleet of . . .

8 LIMA-BUILT 2-6-6-6s

To handle its heavy coal traffic still more efficiently, The Virginian Railway has just put into operation eight four-cylinder, six-coupled articulated steam locomotives. These Lima-built giants are capable of hauling the heaviest freights, over mountain grades, at sustained high speeds.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED INCORPORATED, LIMA, OHIO

NEWS

"Reconversion Chairmen" for Equipment Industry

THE War Production Board has announced the selection of "reconversion chairmen" for some 400 industries as a step in its program to facilitate, as far as the requirements of the armed services permit, the change over of industry from military to civilian production during the period—termed by the W. P. B. "Period One"—between the victory in Europe and the victory over Japan.

In the Transportation division, the "reconversion officer" for which is James M. Hennigan, six reconversion chairmen have been named. James D. Driscoll has jurisdiction over the railroad car and specialties field; M. K. Tate over locomotives and locomotive control equipment; Richard Caswell over street cars, buses, and equipment; F. L. Galbraith over brake actuating mechanisms, repair parts and miscellaneous products under the Transportation Equipment division; Sally T. Challis over track equipment and maintenance of way work equipment; and E. M. Moore over signal equipment.

The chairmen, according to the W. P. B. statement, will "advise and consult" with their various industries on problems affecting machine tools, equipment, construction and materials for reconversion, and "should be consulted on all reconversion problems."

Third Quarter Allocations

INDICATIONS of "some future improvement in the transportation equipment situation" are seen by the Office of Defense Transportation as a result of the War Production Board's recent allotment to it of increased quantities of controlled materials for this year's third quarter. Among other things, the O. D. T. statement called attention to the fact that construction of new passenger cars is now authorized for the first time since 1942 although they will not be in production until early in 1946.

The allocation for passenger-train cars is 5,000 tons of carbon steel and 5,500 tons of alloy steel. According to O. D. T., this will produce "250 coaches, head-end cars and non-luxury type diners, and starts a program of 250 passenger cars quarterly beginning the first quarter of 1946." The program, the statement adds, "is the result of pressure from the O. D. T. for equipment to carry next winter's heavy passenger load caused by the Army's announced 'redeployment' program."

Total third-quarter allocations of carbon steel for transportation are 1,339,588 short tons, the largest 1945 quarterly allocation thus far. It amounts to 87 per cent of the 1,532,136 tons requested by O. D. T. as compared with a second-quarter allotment amounting to only 70 per cent of the amount requested. The total alloy-steel allocation is 128,840 tons as compared with the second quarter's 98,000 tons. "The necessary amounts of copper and aluminum were allotted to accord with the steel allotments," O. D. T. said.

The rail allocation for steam railroads amounts to 495,900 tons, as compared with 417,000 tons in the second quarter. The allotment for track accessories is 244,500 tons. For locomotives, the 41,500 tons requested were allocated. This compares with a second-quarter allocation of 30,000 tons. The previously-reported freight-car allotment of 220,000 tons is 7,000 tons less than the amount requested; but it is expected to cover present schedules of about 11,000 cars to be built in the fourth quarter.

Spraragen Becomes Welding Research Council Director

W. SPRARAGEN, executive secretary, has been appointed to the newly created position of director of the Welding Research Council of the Engineering Foundation. Mr. Spraragen has served as executive secretary of the Welding Research Council since its organization in 1935. He was appointed research assistant to the welding research committee of the National Council of Defense and the Emergency Fleet Corporation in 1918. He was secretary of the division of engineering, National Research Council from 1920 to 1934 and secretary of the American Bureau of Welding from 1921 to 1936. He served as technical secretary of the American Welding Society from 1927 to 1942 and is editor and business manager of the Welding Journal, official publication of the society. Mr. Spraragen was editor of the first two editions of the Welding Handbook published by the American Welding Society and is the author or co-author of many reviews of literature on practcially all phases of welding.

W. Spraragen

I. C. C. Orders Power Brakes on All Freight Cars

THE Interstate Commerce Commission, in an order by Division 3 in the No. 13528 proceeding and an accompanying report on further hearing by Commissioner Patterson, has formally prescribed specifications and requirements for power brakes and appliances for operating power-brake systems for freight service, and has directed the installation of such equipment on all cars used in freight service, except cars equipped with passenger-car brakes, before a date to be set later. The report indicated that, "at least until something better is developed, the AB brake should be considered as in reasonable and substantial conformity with the proposed specifications and requirements, and with the law."

Finding that the record does not afford sufficient information for fixing precise requirements as to the rate at which suitable equipment must be installed or the dates when such installations must be completed, the commission has directed each railroad to file with it, on or before August 28, a statement of its best estimate of the time when it can complete installation of brakes and appliances in conformity with the prescribed specifications on its interchange and non-interchange cars.

Pointing out that the commission has no control over owners of private cars, except that it may require the railroads not to move cars not equipped with approved brakes, the report added that "we are of the view that the installation of AB brakes on private freight cars used in interchange service should proceed coincidentally with whatever program is prescribed for the installation of such brakes on railroad-owned cars."

The proposal of the carriers represented by the Association of American Railroads that cabooses and cars not normally interchanged with other roads should be exempted from the requirements with respect to power brakes, and that the commission's order should apply "in the first instance" only to revenue cars in interchange service, was noted in the report with the following comment:

"Since the Safety Appliance Acts are designed to promote safety in railroad operation, and since good brakes are of primary importance as a safety measure, we are of the view that eventually every car used, whether in interchange service or not, should be equipped with the best available brakes. We shall not, therefore, permanently exempt any equipment subject to the present inquiry from the requirement for installation of AB brakes, with one exception." (This exception, namely, cars equipped with passenger car brakes, also has been proposed by the carriers.)

1944 Association Proceedings

THE 1944 annual proceedings of The Railway Fuel and Traveling Engineers' Association are available through the secretary, T. Duff Smith, 327 South La Salle street, Chicago 4. The price is $3 per copy.

The Car Department Officers' Association proceedings for 1944 are available through the secretary-treasurer, F. H. Stremmel, 59 East Van Buren street, Chicago, at $3 per copy.

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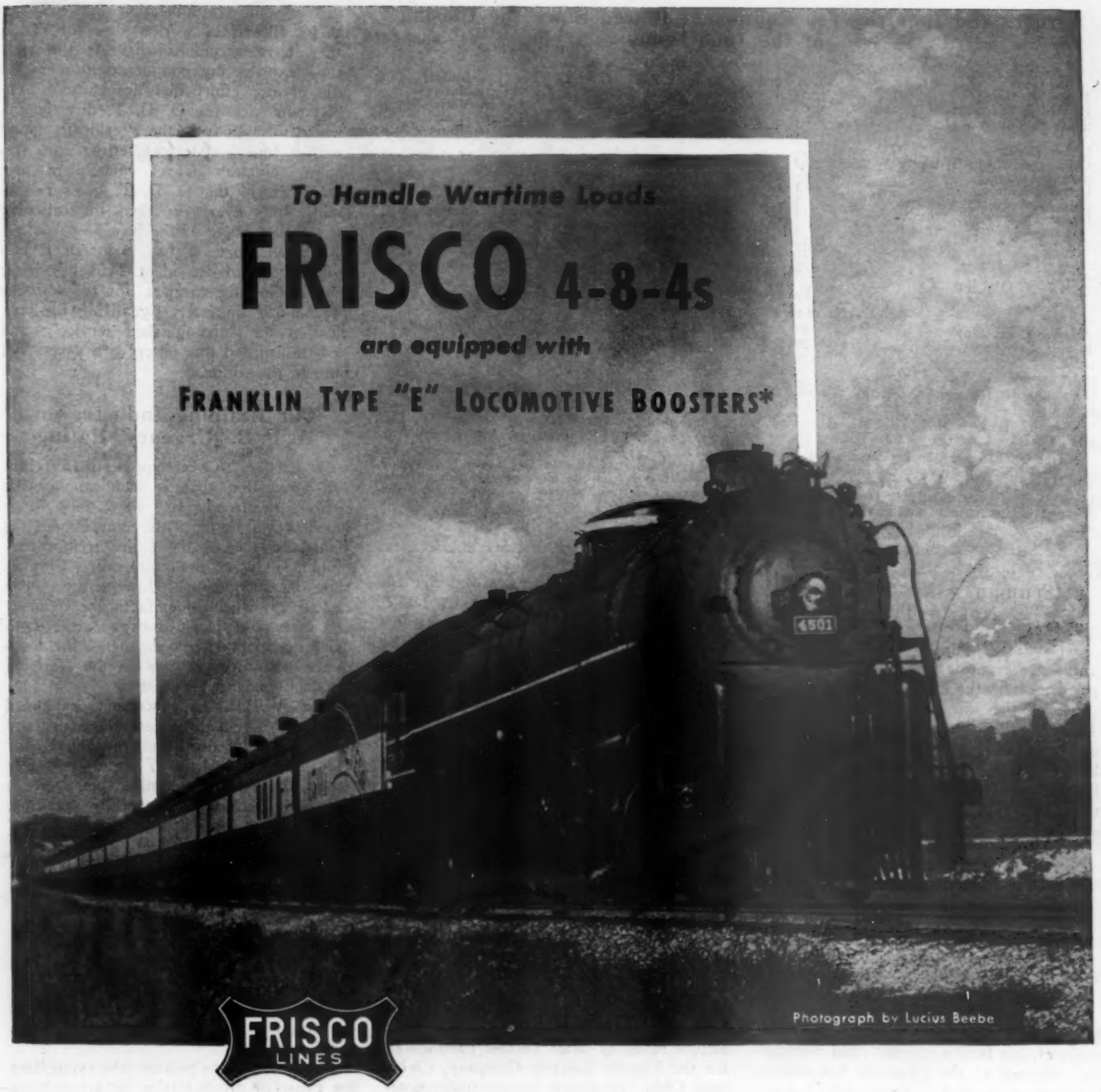


These Frisco 4500 class 4-8-4 locomotives equipped with

FRANKLIN TYPE "E" BOOSTERS*

are used for both fast passenger and freight service to increase traffic capacity.

*Trade Mark Reg. U. S. Pat. Off.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

Orders and Inquiries for Equipment Placed Since the Closing of the June Issue

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Boston & Maine	10[1]	4,000-hp. Diesel-elec.	Electro-Motive
Denver & Rio Grande Western	3	5,400-hp. Diesel-elec. frt.	Electro-Motive
Southern	6	5,400-hp. Diesel-elec. frt.	Electro-Motive
	14	1,000-hp. Diesel-elec. sw.	Electro-Motive
Union Pacific Chicago & North Western Southern Pacific	1	6,000-hp. Diesel-elec. pass.	Electro-Motive
Union Pacific	1	6,000-hp. Diesel-elec.	Electro-Motive
Chicago & North Western	1	4,000-hp. Diesel-elec.	Electro-Motive
Union Pacific	1	4,000-hp. Diesel-elec.	Electro-Motive
	3	2,000-hp. Diesel-elec. units	Electro-Motive
	15	Diesel switchers	Electro-Motive
	10	Diesel switchers	American Loco. Co.
	1	Diesel switcher	Fairbanks-Morse

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Atlantic Coast Line	39[2]	Stainless Steel	Edw. G. Budd
Florida East Coast	20[2]	Stainless Steel	Edw. G. Budd

[1] Two for the Maine Central.

[2] For A. C. L. and connections (Penn. and R. F. & P.) in joint through route from New York to Miami.

[3] Six for through New York-Miami service and 14 for local operations between Jacksonville, Fla., and Miami.

NOTE: The Defense Plant Corporation, at the request of the Office of Defense Transportation, has authorized the acquisition of additional troop sleepers and kitchen cars at a cost of about $20,000,000. This equipment will be used in moving troops in this country during the shift of the armed forces from the European theater to the Pacific. It will be operated by the Pullman Company for the government agency, which will retain title. It is understood that 1,200 troop sleepers and 400 kitchen cars will be built under this authorization.

Truman Asks Americans Not to Travel

APPRAISING the transportation job ahead as "even bigger" than the "miracle" performed by the carriers during the first phase of the war, President Truman on June 7 called upon the public to "lend co-operation in order that the burden may be minimized." In response to questions he said that he was prepared to establish travel rationing if it becomes necessary, although he hopes it will not.

With the statement, the White House also made public the text of a letter the President had written to the O. D. T. director. The letter stated that the transportation facilities of the nation "are now called upon for the most gigantic task in all the history of transportation." It went on to point up the job already done, adding that contemplation of the remaining task "would overtax our faith if we had not found during the course of this war that the impossible had become our daily job."

In closing the President asked Colonel Johnson to "extend my congratulations to all of our transportation agencies—and their millions of workers—on the results they have accomplished. At the same time express my confidence in them for the greater effort that lies ahead." For his own part, the O. D. T. director followed through from the President's appeal with a June 9 statement setting up a six-point voluntary travel curtailment program which, the O. D. T. press release said, "may avert the need for rationing at this late stage of the war."

Colonel Johnson has endorsed a facsimile copy of President Truman's letter commending the carriers, for the *Railway Mechanical Engineer*, signalizing the publication for "distinguished service"; and has transmitted this letter with a personal note to the editor.

Car Building Industry on W. P. B. "Urgency" Rating

IN a move "to overcome a lag in freight car production that is handicapping the nation's railroads as they face their heaviest war burden," the War Production Board has placed the entire freight car-building industry, the entire railroad brake-shoe manufacturing industry, the entire chilled car-wheel manufacturing industry and certain malleable-iron and steel foundries manufacturing components for locomotives and freight cars on the National Production Urgency List.

The W.P.B. announcement explained that the action provides plant urgency ratings "of the third band or better" for 112 plants located in 17 states, and will "open the way for similar elevation in man-power ratings." Generally speaking, it added, only "direct military producers" have higher ratings.

Supply Trade Notes

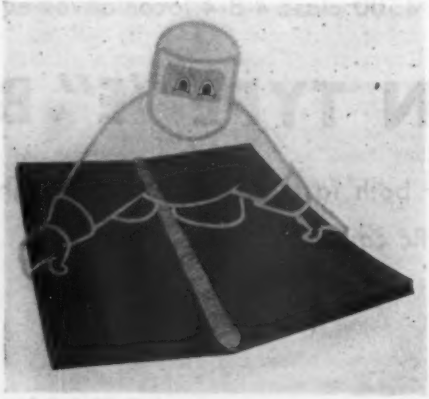
CANADIAN LOCOMOTIVE COMPANY.—*Ralph Schmidt*, assistant chief mechanical engineer, has been appointed chief mechanical engineer of the Canadian Locomotive Company to succeed *G. Cavin*, who has retired after 33 years' service with the company.

◆

CRANE COMPANY.—The Crane Company has announced the following changes in its sales and branch house division: *Carter T. Pollock*, formerly manager of Crane's Chicago branch, has been appointed manager of the central district with headquarters in Chicago; and *W. A. Burbine*, manager of the Cleveland, Ohio, branch, has been appointed manager of the Chicago branch. *A. N. Rosborough*, manager of the Toledo, Ohio, branch, succeeds Mr. Burbine at Cleveland; *W. D. LaRue*, manager of the Muncie, Ind., branch, succeeds Mr. Rosborough at Toledo, and *R. C. Danielson*, manager of the plumbing department at the Indianapolis branch, succeeds Mr. LaRue at Muncie.

◆

LINCOLN ELECTRIC COMPANY.—Fundamentals of welding procedure, particularly those which have to do with the prevention and control of shrinkage are effectively explained in a 16-mm. sound-color motion picture made by Walt Disney Productions for the Lincoln Electric Company, Cleveland, Ohio. To permit an easy understanding of the real cause of distortion, the effect of heat on an ordinary steel bar is portrayed showing just what causes the bar to expand, contract and warp out of shape. The movie then points out how distortion can generally be prevented in any product or structure by the application of three simple rules.



The villain of the picture who symbolizes the cause of all distortion in arc-welding is "Mr. Shrink." This animated character causes a great deal of trouble but is thwarted at every turn and is even unknowingly put to work to overcome distortion in several cases.

The film shows how to reduce the effective shrinking force of a weld, how to make shrinking forces work to minimize distortion, and how to balance shrinkage forces with other forces. The film bears the title "Prevention and Control of Distortion in Arc-Welding." It has a running time of 20 minutes and is available on request at no charge except for transportation.

Mr. Shrink is a character who has been conceived to illustrate the effect of shrinkage forces in arc-welding.

◆

MCCONWAY & TORLEY CORPORATION.—*Rudolph Leppla*, formerly mechanical engineer for the Bettendorf Company, has been appointed chief engineer of the McConway & Torley Corp., of Pittsburgh, Pa.

(*Turn to next left-hand page*)

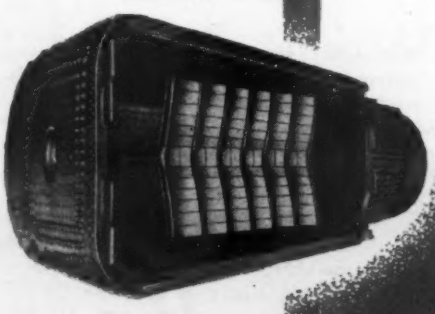
Safety

CAN NEVER BE FULLY AUTOMATIC!

The engineman must always be on the alert to make certain that water glasses and gauge cocks show adequate water in the boiler. This is a routine operating responsibility of the locomotive crew.

But if, under any conditions, the water becomes low, the locomotive equipped with Security Circulators has an added protection.

Security Circulators insure a positive flow of water over the center of the crown sheet at all times, besides strengthening the firebox structure.



AMERICAN ARCH COMPANY, INC.

NEW YORK · CHICAGO

SECURITY CIRCULATOR DIVISION

PITTSBURGH STEEL COMPANY.—*Lt. Col. John Kennedy Beeson,* who recently completed his duties with the United States Strategic Air Forces in Europe, has been elected executive vice-president of the

Lt. Col. John K. Beeson

Pittsburgh Steel Company. Col. Beeson is the son of the late Charles E. Beeson, one of the original founders of the Pittsburgh Steel Company. He was vice-president in charge of sales for the company when he enlisted in the Air Corps in May, 1942. Previously he was assistant general superintendent of the company's plant operations at Monessen and Allenport, Pa. He is a graduate of Yale University.

◆

INTERNATIONAL NICKEL COMPANY; DOW CHEMICAL COMPANY; CARNEGIE-ILLINOIS STEEL CORPORATION.—On June 5-6, 18 engineers and editors of technical publications were shown corrosion tests at the Corrosion Testing Station, Kure Beach, N. C. The visitors were guests of the International Nickel Company, Inc., the Dow Chemical Company, the Ethyl-Dow Chemical Company, and the Carnegie-Illinois Steel Corporation, joint sponsors of this testing station, at which products of more than 200 companies have been exposed to atmospheric or sea-water corrosion.

At this point, on the shore of the Atlantic Ocean, tests of various metals, alloys and coatings have been conducted for periods varying from 5 to 10 years. These tests include samples exposed to sea air and samples completely submerged in sea water, traveling at low and high velocities. At the present time, approximately 15,000 specimens are being exposed to atmospheric corrosion, while about 2,000 specimens comprise the submerged tests. In the past 10 years, a total of about 4,000 specimens have been given submersion tests. In addition, during the past two years, various specimens of treated wood have been submerged in sea water to determine the resistance of different types of treatment to marine borers. A total of about 5,000 specimens of treated wood have been tested to date.

◆

SNAP-ON TOOLS CORPORATION.—The Snap-on Tools Corporation, Kenosha, Wis., recently celebrated its twenty-fourth anniversary.

PITTSBURGH STEEL FOUNDRY CORPORATION.—The Pittsburgh Steel Foundry Corporation, Glassport, Pa., has acquired a controlling interest in the Pittsburgh Spring & Steel Co., which will be operated under its present corporate name as a division of the Pittsburgh Steel Foundry. The following officers have been elected for the Pittsburgh Spring division: *G. D. Thompson,* president; *E. S. Weidle,* vice-president; *M. A. Colville,* treasurer; *Winthrop B. Braun,* secretary; and *David W. Kettering,* assistant secretary-treasurer.

◆

OXWELD RAILROAD SERVICE COMPANY.—*Frank C. Hasse* has been elected vice-president—mechanical department of the Oxweld Railroad Service Company, a unit of the Union Carbide & Carbon Corp. Mr. Hasse began his railroad career in 1904 with the Atchison, Topeka & Santa Fe. Thereafter he was successively a fire-

Frank C. Hasse

man on the Chicago, Burlington & Quincy and engine foreman and general boiler foreman on the Illinois Central System. He started as an instructor with the Oxweld Railroad Service Company in 1913, and was assigned to the Chicago main office in 1916. Mr. Hasse entered the Army as a captain in the first World War. He was appointed superintendent of construction at Camp Normyle, San Antonio, Texas, and subsequently was commanding officer of that camp. After rejoining the Oxweld Company in 1919, he was appointed superintendent of construction and maintenance, and, in 1927, general manager.

Army-Navy "E" Awards

American Steel & Wire Co., Cuyahoga, N. Y. May 22.

Babcock & Wilcox Co., Barberton, Ohio. Fifth renewal.

Broderick & Bascom Rope Co., St. Louis, Mo. Sixth citation.

Dayton Rubber Manufacturing Company, Waynesville, N. C.

Maxim Silencer Company, Hartford, Conn. Fourth star.

Monroe Auto Equipment Company, Monroe, Mich. Fifth award.

National Battery Company, Gould industrial division, Depew, N. Y. Third star.

BALDWIN LOCOMOTIVE WORKS.—*W. F. Boyle* has been appointed assistant to the vice-president to direct the Pacific Coast district office of the Baldwin Locomotive Works and the Pelton Water Wheel Company, wholly owned subsidiary. Mr. Boyle will temporarily assume the duties at the San Francisco, Calif., headquarters formerly performed by *F. R. Kohnstamm,* who has been relieved due to illness. *C. G. Crawford* will continue as acting general manager of Pelton and in addition will be responsible for all industrial sales and service in the Pacific Coast district. *C. D. Allen* continues in charge of railroad sales and service at San Francisco. Mr. Boyle served in various executive engineering capacities with the Westinghouse Electric & Manufacturing Co. following his graduation from the Pratt Institute in 1927. Most recently he was sales manager of the aviation turbine division of Westinghouse.

Frank K. Metzger, vice-president in charge of sales of the Baldwin Locomotive Works, has resigned effective June 30.

◆

AIREON MANUFACTURING CORPORATION.—*Ralph R. Gunderson* has been appointed sales manager of the brake division of the Aireon Manufacturing Corporation with headquarters in Chicago.

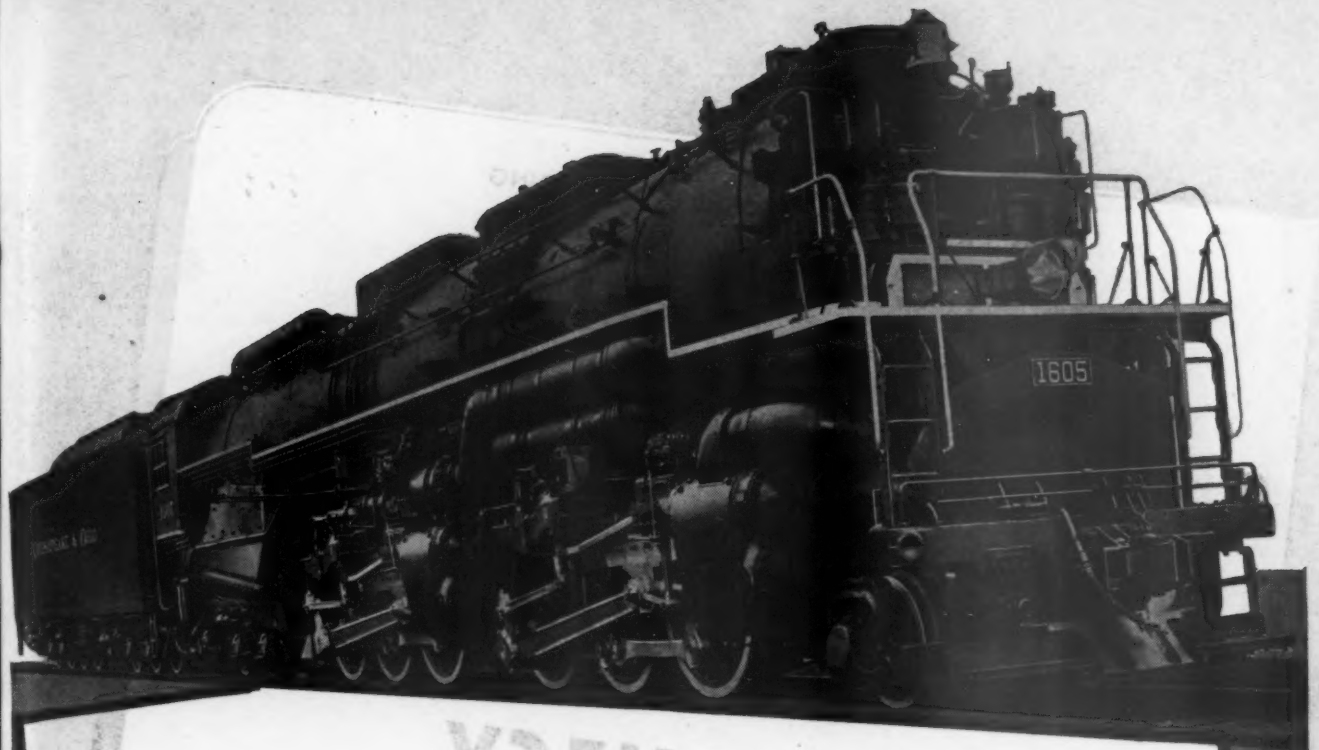
◆

AMERICAN CAR AND FOUNDRY COMPANY.—*Victor R. Willoughby,* vice-president of the American Car and Foundry Company, formerly in charge of engineering and since December, 1943, director of research and development, has retired after almost fifty years of association with the company. Mr.

Victor R. Willoughby

Willoughby is a graduate of Michigan University where he received a degree in mechanical engineering in 1896. He began his career with the Michigan Peninsular Car Company. When that company was taken over by the American Car and Foundry Company at the time of its incorporation in 1899, he was appointed assistant mechanical engineer. He served as engineer at various plants of the company and later in New York, where he subsequently became general mechanical engineer. He was elected vice-president in charge of engineering in February, 1938. During the war, Mr. Willoughby served as assistant chairman and chief civilian officer of the integration committee on the light tank.

(*Turn to second left-hand page*)



It *Pays* to Specify *Higher* Superheat

Higher superheat means higher cylinder efficiency with increased cylinder horsepower. Maximum superheating surface also means more free steam area.

A design for higher superheat should be specified for all new locomotives . . . and can be used to advantage when old power is modernized.

A-1691

IT'S A GREAT NEW DAY FOR RAILROADING

A POSTWAR PROPHECY

GM LOCOMOTIVES

IT'S A GREAT NEW DAY FOR RAILROADING

After the war, industries
will favor railroads
able to deliver
faster, on-time,
dependable freight service.

That is one reason that
General Motors Diesel
freight locomotives are
a "must" on many lists.

ON TO FINAL VICTORY ★ BUY MORE WAR BONDS

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION LA GRANGE, ILL.

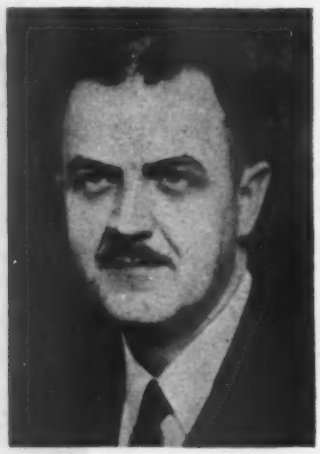
GENERAL STEEL CASTINGS CORPORATION.—*E. G. Hallquist,* special representative in the Chicago district sales office of the General Steel Castings Corporation, has been transferred to the company's Granite City, Ill., plant as assistant vice-president.

◆

COPPERWELD STEEL COMPANY.—*Fred Brown,* New England sales engineer for the Copperweld Steel Company, has been transferred to the home office at Glassport, Pa., as staff engineer in the general sales department. *H. M. MacDougal,* who has been in the sales engineering department at Glassport, succeeds Mr. Brown in the New England territory.

◆

TIMKEN ROLLER BEARING COMPANY.—*O. J. Horger,* formerly in charge of railway engineering and research, has been appointed chief engineer of the railway division of the Timken Roller Bearing Company. *C. L. Eastburg,* who is in active charge of the design of bearings and parts as applied to locomotives, has been ap-



O. J. Horger

pointed assistant chief engineer of the railway division and *P. C. Paterson,* who has been active in the inspection and procure-

P. C. Paterson

ment of material and in equipment applications, has been appointed service manager of the railway division.

O. J. Horger is a graduate of the Carnegie Institute of Technology, with a Bachelor of Science degree, and of Michigan University with a Doctor of Science Degree. While at Michigan University he

C. L. Eastburg

instituted and was in charge of the fatigue testing of locomotive and car axles, a part of a program of general research. He joined the Timken Company in 1924. He is the author of many technical articles and is a member of the American Society of Mechanical Engineering, the American Society for Metals, the American Society for Testing Materials, the Society for Experimental and Stress Analysis and the British Locomotive Institute.

C. L. Eastburg attended Illinois University and joined the Timken Company in 1927. *P. C. Peterson* attended the Carnegie Institute of Technology. He is a member of the American Society for Metals.

◆

CLARK EQUIPMENT COMPANY.—*George Spatta,* executive vice-president, has been elected president of the Clark Equipment Company, Buchanan, Mich., to succeed the late Albert S. Bonner. *John G. Mack* has been elected a vice-president and director of the company. Mr. Spatta was formerly in the employ of the General Electric Company. He joined the Clark organization in 1927, serving successively as development engineer, chief engineer, general manager, and executive vice-president.

◆

WESTINGHOUSE AIR BRAKE COMPANY; UNION SWITCH & SIGNAL COMPANY.—*Albert N. Williams,* president of the Western Union Telegraph Company, has been elected a director of the Westinghouse Air Brake Company and of the Union Switch & Signal Co.

◆

ELECTRO-MOTIVE DIVISION, GENERAL MOTORS CORPORATION.—*Nelson C. Dezendorf* has been appointed a director of sales of the Electro-Motive Division of the General Motors Corp. with headquarters at La-Grance, Ill. This is a new position. *O. F. Brookmeyer* will continue in the position of sales manager, until his impending retirement under a General Motors pension plan.

Nelson C. Dezendorf was born at Portland, Ore., on April 23, 1898. He received his higher education at the University of Oregon and the University of California. He served in the armed forces during World War I and in 1920 entered the employ of the European Pacific Steamship Co., where he was engaged in making surveys of West Coast and European port activities. In 1922 Mr. Dezendorf went with the General Motors Acceptance Corp., at Portland, and five years later was appointed manager of the Seattle, Wash., office of that organization. Some time later he was transferred to the business development department at New York, becoming manager of that department in 1929. In 1931 he was elected a vice-president of G. M. A. C., and in the following year was given a special assignment in the sales section of General Motors at Detroit, Mich. On January 1, 1941, Mr. Dezendorf became a director and a member of the executive committee of G. M. A. C. He relinquished these positions later in 1941 to become general assistant to the vice-president in

Nelson C. Dezendorf

charge of distribution of General Motors. When R. H. Grant, the then vice-president in charge of disttribution, retired in January, 1944, Mr. Dezendorf became director of the distribution staff.

◆

UNION ASBESTOS & RUBBER CO.—*John S. Lundvall* has been appointed manager of the equipment specialties division in charge of

John S. Lundvall

sales and engineering of the Union Asbestos & Rubber Co. to succeed *George A. Hull,* who has been transferred to Los Angeles, Calif. Mr. Lundvall joined the company in 1925 as a mechanical engineer.

AMERICAN LOCOMOTIVE COMPANY.—The American Locomotive Company and Union College have entered into a contract under which the American Locomotive Company will enlarge the physics laboratories of the college in exchange for the use of certain laboratory and other facilities and for help on specific technical problems by members of the Union College science faculty. The company has agreed to provide the college with ten or twelve new physics laboratories and to supervise their building under the present physics building on the campus. Construction is to be completed within a year. The college for a period of five years after completion of the laboratories is to designate one of the laboratories for use by the company and is to equip and maintain it. In addition the college is to make available to the company during the five-year period faculty and research personnel for work with the company in its laboratory and for at least four meetings a year during which the college and company representatives will make shop inspection trips and discuss any company problems submitted to them.

◆

BETTENDORF COMPANY.—*Herman Mangelsdorf*, until recently in the mechanical engineering department of the Chicago, Rock Island & Pacific at Silvis, Ill., has been appointed to the engineering staff of the Railway division of the Bettendorf Company, where he will be assigned to railway specialty designing. Mr. Mangelsdorf has been employed since 1922 chiefly in the engineering departments of the Union Pacific at Omaha, Neb., and of the Rock Island at Silvis, where he had to do with car and locomotive design.

◆

ELECTRIC SERVICE MANUFACTURING COMPANY.—*A. H. Englund*, president and treasurer of the Electric Service Manufacturing Company, Philadelphia, Pa., has been elected chairman of the board and treasurer. *H. G. Lewis*, vice-president and general manager, has been elected president and general manager. *Russell Kreinberg* has been appointed vice-president and assistant general manager, and *I. W. Schmidt*, western manager, has been appointed a vice-president, with headquarters as heretofore in Chicago.

◆

OLIVER IRON & STEEL CORPORATION.—*Edward M. Welty*, assistant general manager of sales, has been appointed general manager of sales of the industrial fasteners division of the Oliver Iron & Steel Corporation to succeed *James G. Graham*.

◆

NATIONAL BATTERY COMPANY.—*Richard H. Rowland*, vice-president in charge of the National Battery Company's Gould industrial division, Depew, N. Y., has been appointed to the added responsibility of general sales manager to succeed *John C. Sykora*, vice-president in charge of sales, who has resigned. Mr. Rowland is a graduate of Michigan University. He was vice-president of the St. Paul Engineering & Manufacturing Company prior to his recent connection with National Battery.

Obituary

W. T. BRASSIL, vice-president and general manager of the Adams & Westlake Co., with headquarters at Elkhart, Ind., died in a Chicago hospital on June 3.

◆

BYERS W. KADEL, consulting engineer for the Symington-Gould Corporation since 1920 with headquarters in Baltimore, Md., died May 28. Mr. Kadel was employed as draftsman and car designer for the Norfolk & Western from 1909 to 1918 and served as assistant engineer with the United States Railroad Administration from 1918 to 1920.

◆

LEROY S. WRIGHT, who retired a few years ago from the railway sales department of the National Malleable & Steel Castings Company, died at Winfield, near Chicago, on May 15. Mr. Wright entered the employ of the National Malleable & Steel Castings Company at Sharon, Pa., October 1, 1900, and in 1907 was transferred to the railway sales department at Chicago. Mr. Wright was active over many years in the Railway Supply Manufacturers' Association, which sponsored the exhibits at the Atlantic City, N. J., conventions of the Mechanical and Purchases and Stores Divisions of the Association of American Railroads. He served on various committees of the Supply Association; became a member of the Executive Committee in 1920; was elected vice-president in 1922, and served as president 1924-1926.

Personal Mention

General

J. E. GOODWIN, assistant chief mechanical officer of the Chicago & North Western and the Chicago, St. Paul, Minneapolis and Omaha, has been appointed chief mechanical officer. Mr. Goodwin entered railway service as machinist apprentice in the employ of the Atchison, Topeka & Santa Fe in 1918, and after completion of his apprenticeship, entered college to study engineering at Lake Forest College and the University of Chicago. He re-entered railway service in 1926 as a machinist on the Missouri Pacific at Hoisington, Kan., and a year later was promoted to enginehouse foreman. In 1929 he became erecting foreman of the back shop at North Little Rock, Ark.; in 1932, schedule supervisor, and later production engineer. In 1935, he was appointed general foreman at North Rock shops and in 1939 acting shop superintendent. On January 28, 1941, he was appointed master mechanic of the Palestine and San Antonio divisions of the International-Great Northern, with headquarters at San Antonio, Tex.; on January 1, 1942, mechanical superintendent of the Missouri Pacific Lines with headquarters at St. Louis, Mo., and on October 1, 1943, assistant mechanical officer of the C. & N. W. and the C. St. P. M. & O., with headquarters at Chicago. Mr. Goodwin is president of the Locomotive Maintenance Officers' Association, and a member of the board of directors of the Western Railway Club.

J. E. Goodwin

HORACE M. WARDEN, chief mechanical officer of the Missouri-Kansas-Texas at Dallas, Tex., has been appointed vice-president and general manager, with headquarters at Dallas. Mr. Warden entered railway service in 1914 as a machinist in the employ of the M-K-T. After subsequent promotions he became superintendent of the reclamation plant at Parsons, Kan., in 1916. In January, 1924, he was appointed superintendent of shops at Bellmead, Waco, Tex.; in February, 1924, superintendent of the locomotive department of shops at Parsons; in August, 1925, mechanical superintendent at Parsons, and in October, 1927, chief mechanical officer.

Horace M. Warden

(*Turn to third left-hand page*)

Right for both jobs because it's built for both jobs

THE trains you see on these two pages are being pulled by the New York Central's new dual-purpose locomotive, the "Niagara."

Built by the American Locomotive Company, in close co-operation with the New York Central, it is designed to pull the System's crack passenger liners and also meet the demands for high speeds in hauling freight. Locomotives that possess the *interchangeability* of the "Niagara" promise many benefits. They can help reduce the expense many railroads have had to bear in buying, operating and maintaining powerful locomotives for heavy freight hauls and faster, less powerful locomotives for lighter passenger runs.

They can provide a new kind of operating efficiency by building up extra power needed for tough jobs, and conserving power on the easier tasks.

And, perhaps most important of all, they can open new roads to undreamed-of economies—savings that will be shared by thousands.

American Locomotive

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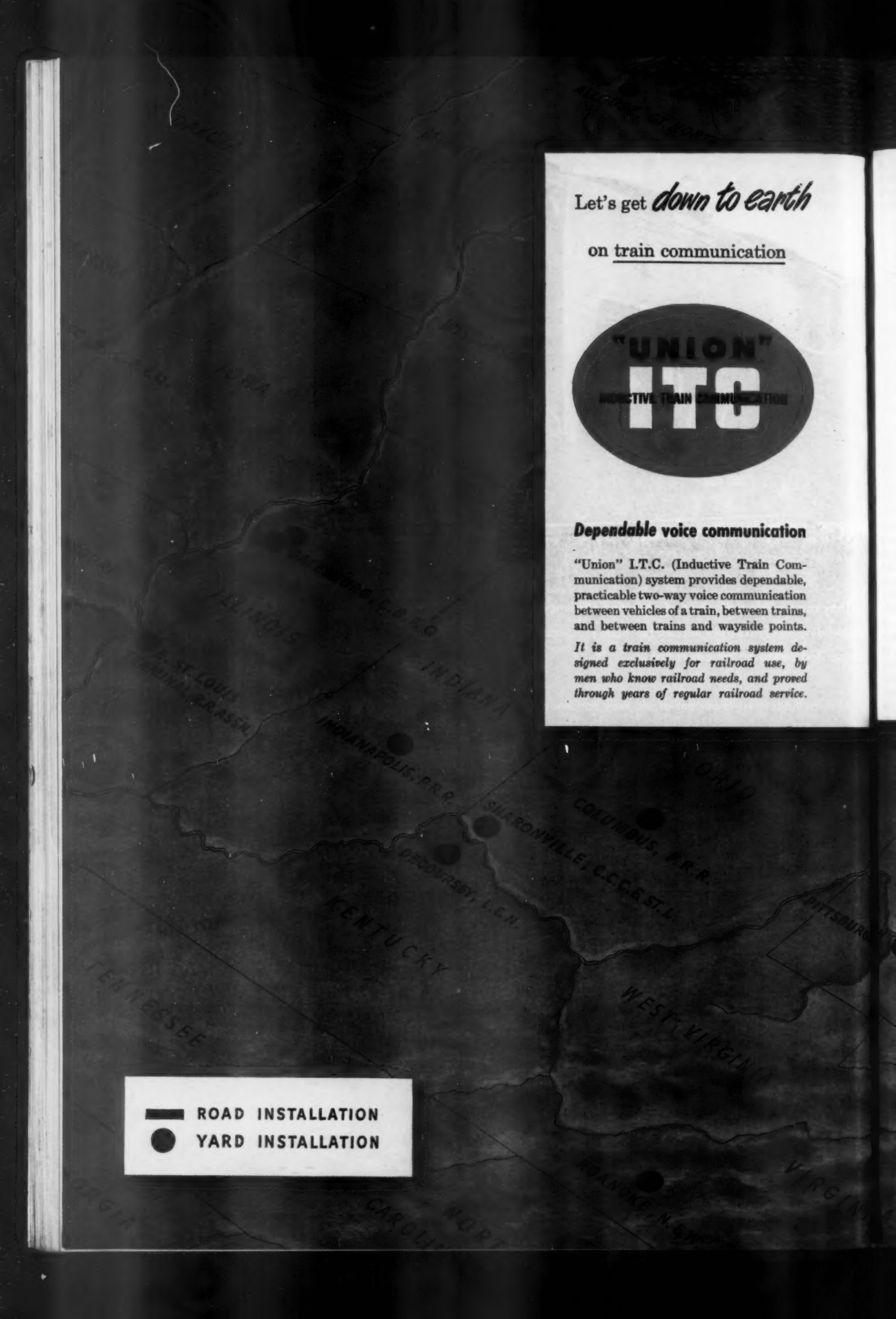
THE MARK OF MODERN LOCOMOTION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on train communication
"UNION"
ITC
INDUCTIVE TRAIN COMMUNICATION
Dependable voice communication
"Union" I.T.C. (Inductive Train Communication) system provides dependable, practicable two-way voice communication between vehicles of a train, between trains, and between trains and wayside points.
It is a train communication system designed exclusively for railroad use, by men who know railroad needs, and proved through years of regular railroad service.
ILLINOIS
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COLUMBUS, P.R.R.
OHIO
KENTUCKY
TENNESSEE
WEST VIRGINIA
ROANOKE, N.&W.
ROAD INSTALLATION
YARD INSTALLATION

Proved in regular railroad service

When you're considering train communication systems, keep this fact in mind—*"Union" I.T.C. is the only system that has been thoroughly proved through years of regular railroad use in yards and in road service.*

Here's the record:

Bessemer & Lake Erie R.R. Co.	Road (Albion, Pa. to Pittsburgh)
Cleveland, Cincinnati, Chicago & St. Louis Ry.	Yard (Sharonville, Ohio)
Chicago, Burlington & Quincy R.R. Co.	Yard (Two Yards—Galesburg, Ill.)
Chicago, Burlington & Quincy R.R. Co.	Yard (Lincoln, Neb.)
Great Northern Ry. Co.	Yard (Allouez, Wis.)
Louisville & Nashville R.R. Co.	Yard (DeCoursey, Ky.)
Norfolk & Western Ry. Co.	Yard (Roanoke, Va.)
The Pennsylvania R.R.	Yard (Two Yards—Altoona, Pa.)
The Pennsylvania R.R.	Yard (Columbus, Ohio)
The Pennsylvania R.R.	Yard (Two Yards—Harrisburg, Pa.)
The Pennsylvania R.R.	Yard (Indianapolis, Ind.)
The Pennsylvania R.R.	Yard (Pitcairn, Pa.)
The Pennsylvania R.R.	Yard (Strip District—Pittsburgh, Pa.)
The Pennsylvania R.R.	Road (Pittsburgh, Pa. to Harrisburg Under Construction)
The Pennsylvania R.R.	Road (Trenton, N.J. to Phillipsburg)
Terminal R.R. Association of St. Louis	Yard (East St. Louis, Ill.)

Proved in regular service—proof that for dependable train communication, *"Union" I.T.C. is the answer.*

Full information will be furnished without obligation by our nearest district office.

UNION SWITCH & SIGNAL COMPANY

SWISSVALE, PA.

NEW YORK CHICAGO ST. LOUIS SAN FRANCISCO

T. F. POWERS, whose promotion to assistant to the vice-president of the Chicago & North Western, with headquarters at Chicago, as announced in the June issue, was born at Winona, Minn., on October 2, 1882. He entered railway service on May 1, 1899, as a water boy in the bridge and building department of the North Western at Winona. Two years later he became an apprentice in the locomotive shops at Winona and in 1906 completed his training as a mechanic. In 1907 Mr. Powers became a mechanic in the employ of the Duluth, South Shore & Atlantic at Marquette, Mich., and in July, 1908, returned

T. F. Powers

to the North Western. He was promoted to the position of foreman at Chadron, Neb., one year later. In 1926 he became assistant superintendent of motive power and machinery, Northern district; in December, 1941, superintendent of motive power, Northern district, with headquarters at Chicago, and in 1943 chief mechanical officer.

COLUMBUS R. RUSH, whose promotion to mechanical superintendent of the Missouri Pacific, with headquarters at St. Louis, Mo., was reported in the May issue, was born at Cameron, Tex., on September 17, 1901, and attended the Arkansas State Teachers College. He entered the service of the Missouri Pacific in February, 1923, as a machinist apprentice and four years later became a machinist, serving at various points. In 1930 Mr. Rush was appointed

Columbus R. Rush

enginehouse foreman; in 1941, general enginehouse and shops foreman at St. Louis; in August, 1944, assistant master mechanic, with headquarters at DeQuincy, La., and in January, 1945, master mechanic, at Kingsville, Tex.

C. L. WILSON, superintendent of motive power of the Elgin, Joliet & Eastern, retired on May 14.

J. L. CARVER, mechanical engineer of the Illinois Central at Chicago, has been appointed research engineer, with headquarters at Chicago.

F. P. THEISEN, chief clerk, mechanical department of the Chicago & North Western, with headquarters at Chicago, has been appointed assistant to the chief mechanical officer.

P. O. CHRISTY, general superintendent of equipment of the Illinois Central at Chicago, has been granted a leave of absence because of illness.

F. S. ROBBINS, general superintendent motive power of the Atlantic Coast Line at Wilmington, N. C., has resigned on furlough until the end of this year, when, at the age of 65, he will retire under the provisions of the Railroad Retirement Act.

H. E. MAY, shop engineer of the Illinois Central at Chicago, has been appointed superintendent of equipment; with headquarters at Chicago.

S. O. RENTSCHLER has been appointed superintendent of motive power of the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill.

HAROLD FORSYTH FINNEMORE, whose appointment as chief electrical engineer of the Canadian National was announced in

Harold Forsyth Finnemore

the June issue, was born at Chicago on March 18, 1893, and received his B. S. degree in electrical engineering from Queen's University in 1917. He entered railroading the following year as a draftsman in the employ of the Canadian Government Railways. In September, 1922, he was appointed assistant engineer of the Canadian National; in 1923, assistant electrical engineer, with headquarters at Montreal; in July, 1938, electrical engineer at Montreal, and in December, 1943, assistant chief electrical engineer.

W. R. HARRISON, mechanical superintendent of the Southern district of the Atchison, Topeka & Santa Fe at Amarillo, Tex., is on a leave of absence because of illness.

RAMSEY GRAY GAGE, whose retirement as chief electrical engineer of the Canadian National at Montreal, Que., was announced in the June issue, was born at Kingston,

Ramsay Gray Gage

Ont., on July 14, 1879. He is a graduate of Queen's University at Kingston where he received his B. S. degree in electrical engineering in 1905. He served with the Cataract Power Company at Hamilton, Ont., and the Westinghouse Manufacturing Company at Pittsburgh, Pa., successively until 1907, when he entered the service of the Chicago & Eastern Illinois as supervisor of electric signaling. He served as chief engineer of the General Railway Signaling Company at Lachine, Que., from 1910 to 1914, when he joined the Canadian Government Railways (now the Canadian National) as signal and electrical engineer at Moncton, N. B. In 1922 he was appointed electrical engineer for the system with headquarters at Montreal and in 1926 became chief electrical engineer. In December, 1939, his jurisdiction was extended to include the duties of signal engineer.

FREDERIC WARD BUTT, assistant engineer, office of the equipment electrical engineer, of the New York Central System at New York, has retired after 40 years of service. Mr. Butt, who is 68 years old, entered the

Frederic Ward Butt

service of the New York Central in 1905 as assistant engineer, equipment engineering department. He aided in the electrification of the railroad and also designed many locomotives. His work was partly responsible for the development of electric trains to replace steam trains on the Grand Central Terminal rails from the Terminal to White Plains, N. Y., and Harmon; Mr. Butt also worked on the design, construction, inspecting and testing of the electric multiple unit suburban cars, the first steel passenger cars on the line which were the models for the present commuter trains. Among Mr. Butt's other designs were electric and Diesel-electric locomotives, electric lighting equipment on the trains and electric lighting and train-stop equipment for locomotives.

G. J. LEHNERER, lead draftsman of the Illinois Central at Paducah, Ky., has been appointed mechanical engineer with headquarters at Chicago.

JAMES B. DIVEN, superintendent of motive power of the Eastern Ohio division of the Pennsylvania at Pittsburgh, Pa., has been appointed assistant to the general superintendent of the Eastern division.

ALONZO G. TRUMBULL, whose appointment as general mechanical engineer of the Chesapeake & Ohio, the New York, Chicago & St. Louis, and the Pere Marquette

Alonzo G. Trumbull

at Cleveland, Ohio, was announced in the June issue, was born at Hornell, N. Y., and received his M. E. degree from Cornell University in 1899. He entered railroading in 1902 as engineer of tests of the Erie and the following year became mechanical engineer. After serving as assistant mechanical superintendent at Meadville, Pa., from 1905 to 1907, he transferred to the Ohio division, being appointed mechanical superintendent shortly thereafter. In 1912 he transferred to the Erie division; in 1914 was appointed assistant to the general mechanical superintendent; in 1919, assistant general mechanical superintendent; in 1920, mechanical superintendent of the Ohio region, and in 1922, chief mechanical engineer of the Erie. In 1929 Mr. Trumbull was appointed chief mechanical engineer of the Advisory Mechanical Committee for the Erie, the Chesapeake & Ohio, the New York, Chicago & St. Louis, and the Pere Marquette, acting in advisory capacity in matters relating to the design of new rolling equipment. In addition to his duties as general mechanical engineer of the Chesapeake & Ohio, Pere Marquette, and New York, Chicago & St. Louis, he will continue as chief mechanical engineer of the Advisory Committee.

LAMAR EARLE CREVASSE, superintendent motive power, of the Macon, Dublin & Savannah at Macon, Ga., has retired. Mr. Crevasse was born at Cedar Keys, Fla., on August 9, 1895, and entered the employ of the Atlantic Coast Line as an apprentice machinist at High Springs, Fla., in February, 1912. He served as machinist at High Springs from August, 1917, to December, 1917, when he became an instructor in the air service of the U. S. Army. He returned to the Atlantic Coast Line as machinist at High Springs in April, 1919. From September, 1919, to July, 1922, he was in the service of the Florida East Coast at Miami, Fla. Mr. Crevasse joined the Seaboard Air Line as machinist at Jacksonville, Fla., in October, 1922; became enginehouse foreman there in January, 1923; general foreman at Tampa, Fla., in October, 1924; master mechanic at Palm Beach, Fla., in February, 1926, and general foreman at Arcadia, Fla., in 1928. He was subsequently transferred to Tampa and Raleigh, N. C., successively, until February 1, 1940, when he was appointed superintendent, motive power, of the Macon, Dublin & Savannah.

A. G. KANN, general master mechanic of the Illinois Central at Waterloo, Iowa, has been appointed general superintendent of equipment, with headquarters at Chicago.

Car Department

OREL C. FARISS, who has been appointed superintendent, car department, of the Virginian at Princeton, W. Va., as noted in the June issue, was born at Goodland, Ind., on April 18, 1896. He entered railroading on March 8, 1916, as an air brake repairman in the employ of the Norfolk & Western at Kimball, W. Va. After serving with the United States armed forces from November, 1917, to 1919, he returned to his old position at Kimball in August, 1919, and was promoted to gang foreman there the following March. In June, 1921, he transferred to Bluefield, W. Va. A year later he became assistant car foreman at Crewe, Va.; car foreman at Lynchburg, Va., in February, 1924; assistant car foreman at Crewe in July 1924, and car foreman at Clare, Ohio, on June 1, 1927. He served as car foreman at Columbus, Ohio, from November 1, 1936, until his appointment as superintendent, car department, at Princeton.

Orel C. Fariss

In Military Service

1st Lt. Raymond Tillack, of Company B, 756th Railway Shop Battalion, has been promoted to the rank of captain, according to a recent issue of "The Yankee Boomer." Captain Tillack, before entering the service, was an enginehouse foreman on the Pennsylvania.

Shop and Enginehouse

J. A. WELSCH, master mechanic of the Illinois Central at Paducah, Ky., has been appointed shop superintendent, with headquarters at Paducah.

R. R. ROYAL, shop superintendent of the Illinois Central at Paducah, Ky., has retired because of ill health.

Obituary

ALBERT JAY CLARKSON, superintendent of electric equipment of the New York Central Lines Buffalo and East, with headquarters at Harmon-on-Hudson, N. Y., died on June 4 at his home at Yonkers, N. Y. Mr. Clarkson, who was born at Bloomington, Ill., on August 4, 1893, received his B. S. degree from the University of Illinois in 1916, and a degree in electrical engineering in 1932. He entered the employ of the New York Central in 1916, serving until 1923 in the electrical engineering department as draftsman, inspector and assistant engineer successively. In 1923 he was appointed general inspector in the electric equipment department, and in 1928 superintendent of electric equipment.

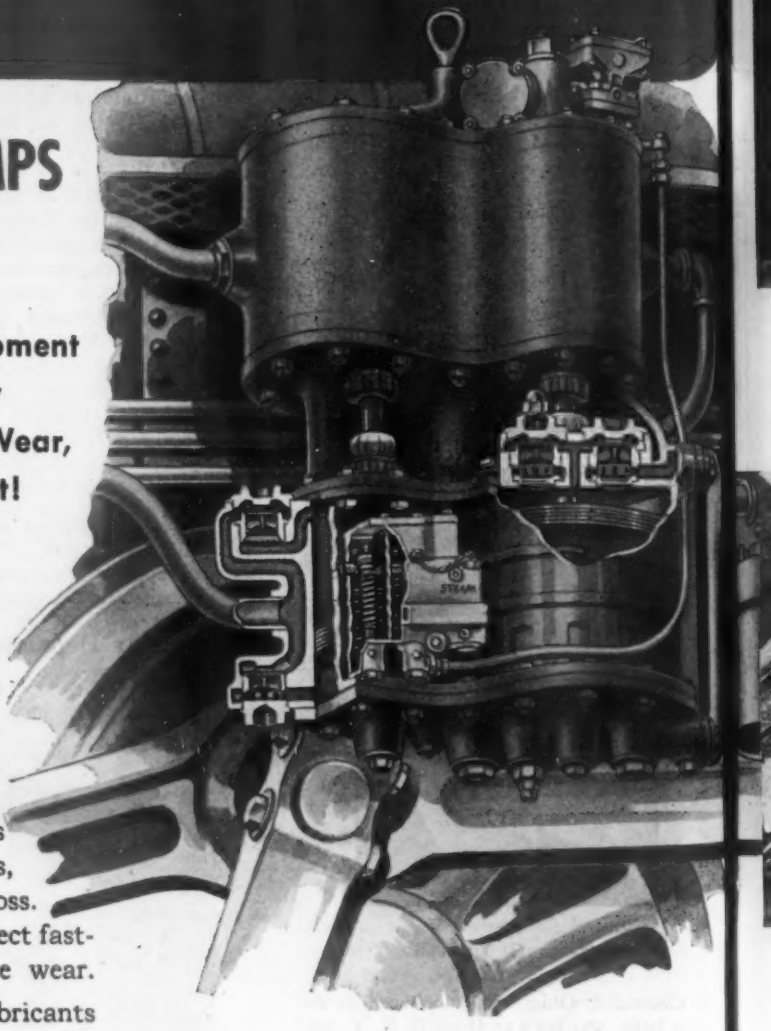
A. T. Clarkson

J. L. CANTWELL, master mechanic of the Southern at Briston, Va., died on June 4.

GIVE YOUR POWER THIS EXTRA PROTECTION!

INSIDE AIR PUMPS LIKE THIS—

and on ALL Railroad Equipment Correct Lubrication by Socony-Vacuum Reduces Wear, Increases Power Output!



THIS CUTAWAY of a cross compound steam-driven air compressor shows you why correct lubrication is vitally important to assure continuous, full-power performance.

In both high and low-pressure air cylinders oil must keep valves *clean*, rings free in their grooves, to prevent blow-by and power loss. It must form strong films to protect fast-moving pistons against excessive wear.

Special Gargoyle railroad lubricants meet these exacting requirements. These oils were developed and tested in close cooperation with builders of this type steam locomotive air compressor. Their successful performance is typical of scores of Gargoyle lubricants proved outstanding in railroad operation.

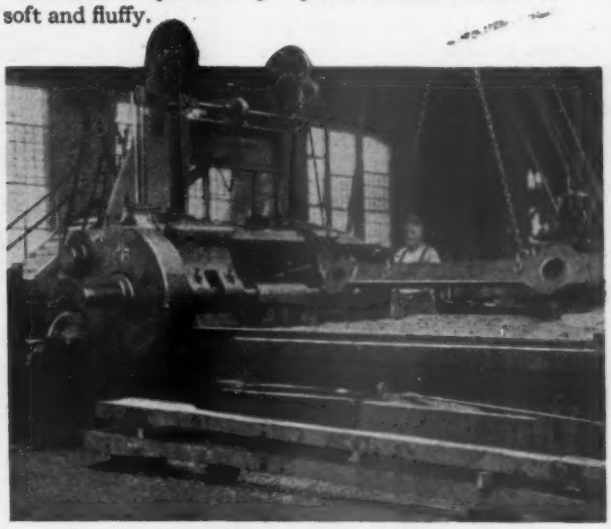
For extra protection of vital moving parts of steam and Diesel locomotives, maintenance-of-way and shop equipment, call in your Socony-Vacuum Representative. His skilled engineering counsel will assure recommendation of the correct oils and greases that will reduce wear and power consumption, increase equipment life.

SOCONY-VACUUM OIL COMPANY, INC.—Standard Oil of N. Y. Division · White Star Division · Lubrite Division · Chicago Division · White Eagle Division · Wadhams Division · Magnolia Petroleum Company · General Petroleum Corporation of California

DIESEL LOCOMOTIVES. Severe operating temperatures and pressures inside Main Line Diesel engine cylinders require lubricating oils that resist the formation of hard carbon deposits, maintain a protecting oil film, form a tight piston seal.

Gargoyle D.T.E. Oils (Nos. 1 to 5) meet these important needs. Their strong films resist rupture, assure full piston seal. Their high chemical stability prevents hard carbon deposits. Any deposits which do form are soft and fluffy.

MAINTENANCE-OF-WAY. Special Socony-Vacuum oils and greases for cranes and other heavy equipment, air-driven track tools and Diesel-powered tractors provide excellent protection against wear, help lower maintenance costs.



SHOP LUBRICATION. Socony-Vacuum has developed improved lubricants for all railroad shop machines. Get the correct grades for your equipment...*plus* the assistance of your Socony-Vacuum Representative to assure scientific application.

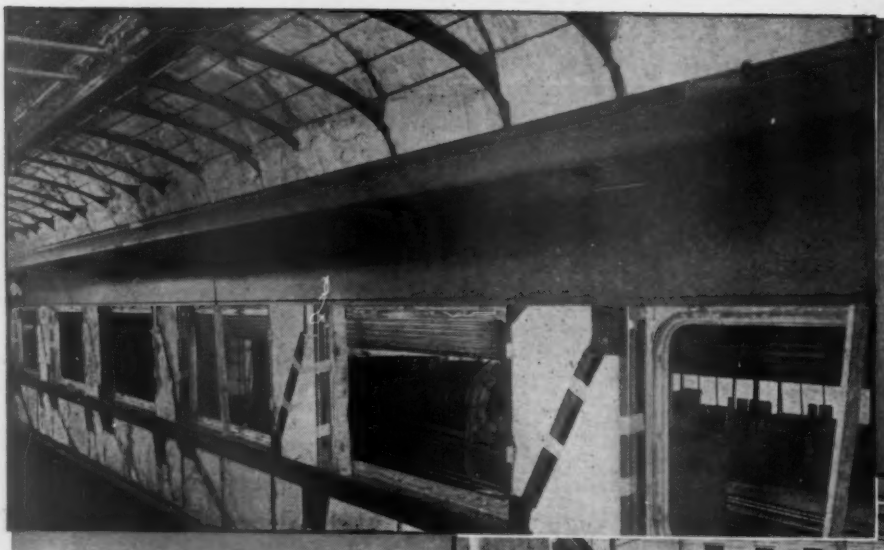
GARGOYLE

Railroad Lubricants

IT PAYS TO KNOW WHAT'S NEW IN LUBRICATION

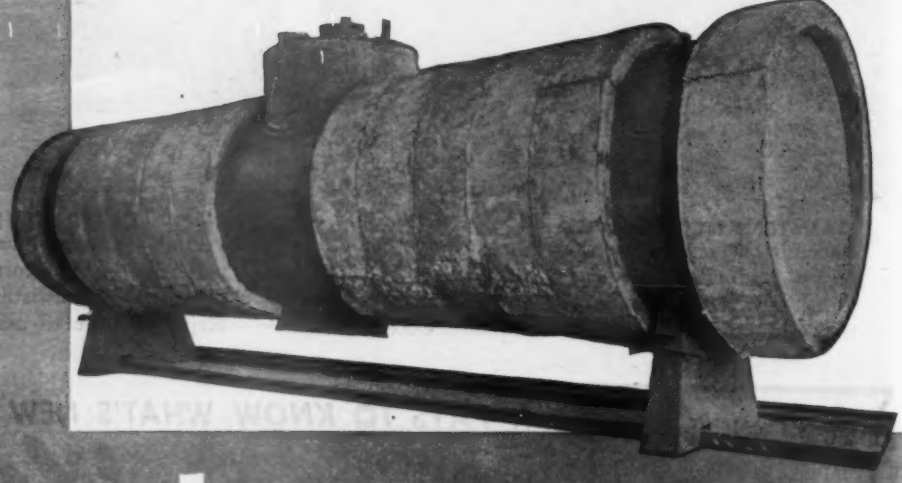
SOCONY-VACUUM

OIL COMPANY, INC.



Fiberglas Passenger Car Insulation has been tested, approved and used extensively by every major railroad and car builder—on practically all deluxe "name trains."

The outstanding characteristics of Fiberglas make it the ideal ***Refrigerator Car Insulation*** and millions of square feet are giving complete satisfaction in this most rigorous service.



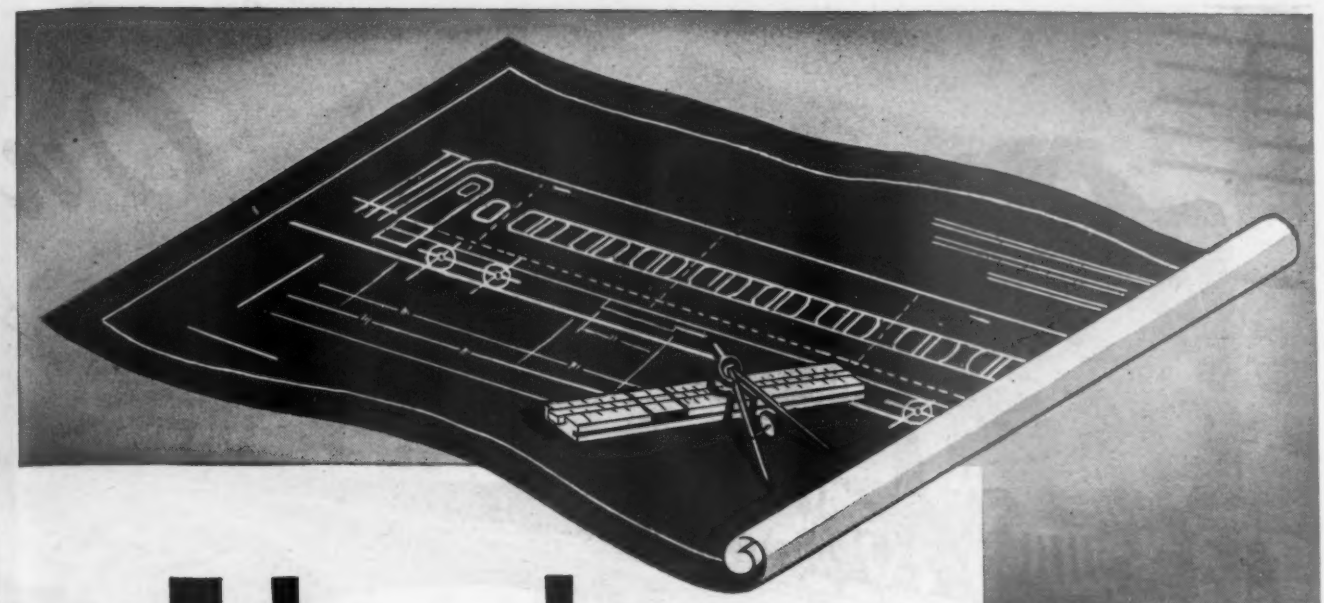
G-B Special Fiberglas Metal Mesh Blankets are installed on thousands of Tank Cars in commercial service and in the special transport service of Government Agencies.

Fiberglas*

*Trademark Reg. U. S. Pat. Office by Owens-Corning Fiberglas Corp.

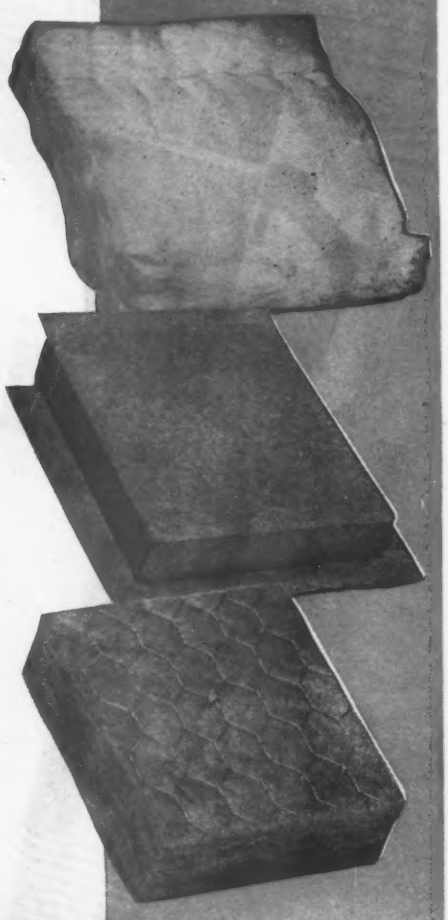
G·B MFG. CO.

ESTABLISHED 1898



Fiberglas*

*Trademark Reg. U. S. Pat. Office — By Owens-Corning Fiberglas Corp.



IS THE WORD TO WRITE INTO THE INSULATION SECTION OF YOUR SPECIFICATIONS *NOW!*

Out of the urgency and new demands of war have come valuable new techniques and fabrications of Fiberglas insulations... developed through our close cooperation with the Navy, Army, Maritime Commission and shipyards. These extraordinary developments are available to railroads and car builders for the improved insulation, comfort and quietness of their passenger cars...and for better protection of refrigerated or chemical lading.

Fiberglas is fireproof, it relieves load on air-conditioning and heating equipment—it is light weight, provides no sustenance for vermin, will not sustain bacterial or fungus growths. Investigate the insulation that is permanent and efficient year after year and specify Fiberglas for your railroad cars while they are in the blue-print stage. Write us now for complete information.

***Fiberglas** is Sold to Railroads and Car Builders exclusively by*

GUSTIN-BACON MANUFACTURING CO.

KANSAS CITY 7, MISSOURI

ARMY E NAVY

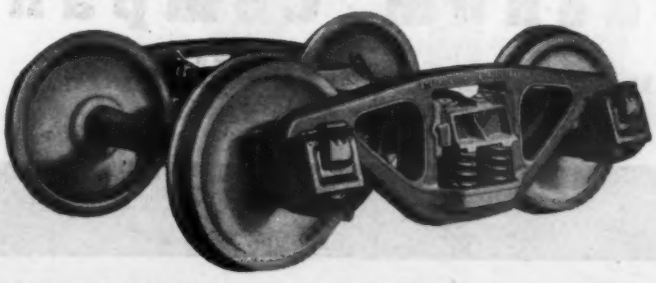
New York Philadelphia Chicago Tulsa Houston Fort Worth San Francisco

11,000 car sets of the A.S.F. Ride-Control Truck (A-3) are already in service or on order for 23 railroads and car owners for applications ranging from box-express* to hopper cars.

MINT-MARK OF ⬡ FINE CAST STEEL

* These cars often exceed 100 m.p.h. Some have gone over 100,000 miles.

A·S·F *Ride-Control* TRUCK



LONG SPRING TRAVEL · CONSTANT FRICTION CONTROL

AMERICAN STEEL FOUNDRIES

CHICAGO

FUMBLEPROOF!

When the engineer reaches for a valve, he wants it *there!* Close to hand . . . convenient . . . fumbleproof. In brief, he wants to watch the road, not grope for a valve.

That's one reason why engineers favor the

SELLERS TYPE "S" INJECTOR

. . . with its single lever that controls all functions . . . starting, stopping, regulating capacity and overflow.

Other features: convenience and safety, less cost for renewals and labor, minimum loss of water when starting and stopping, no water hammer or bulging steam lines, permits complete drainage of water tank when needed. High above the rails, it clears all roadbed hazards.

No wonder the Sellers has become standard equipment on our major railroads! We'll be glad to give you complete technical information . . . **Wm. Sellers & Co., 1630 Hamilton St., Philadelphia.**

SELLERS

PRECISION TOOLS SINCE 1848

Permits Free Movement of Car Trucks on Curves

EDWIN S. WOODS & COMPANY

NO. 1126 Forged Steel Roller Side Bearings

This means—Reduced Wear on Wheel Flanges and Rail Heads... Increased Train Loads... Saving in Fuel... Lower Maintenance Costs

The Edwin S. Woods No. 1126 Forged Steel Roller Side Bearing consists of only two parts, the housing and the roller.

The housing is made of special forging quality S.A.E. steel, and heat treated to insure a high Brinell.

The roller is forged from special forging quality S.A.E. steel, heat treated and oil quenched and is centered by gravity. This rugged two-piece construction feature allows a minimum of clearance between the housing side walls and the roller, thus assuring a true position of the roller at all times.

The web and rim construction not only permits complete heat treatment, but also allows for a lighter and stronger A.A.R. bearing for all types of rolling stock.

Keep transportation going with all possible savings . . . keep more traffic rolling more economically by equipping all your rolling stock with Woods Roller Side Bearings.

LONGER LIFE—LESS REPLACEMENT OF SIDE BEARINGS

In order to obtain maximum hardness and toughness, important to long-lived wearing properties, roller bearings are heat treated. Because of the Woods' recessed roller design, with its rim and web construction, proper equalization of metal structure is obtained throughout by heat treatment. ***Write for Bulletin.***

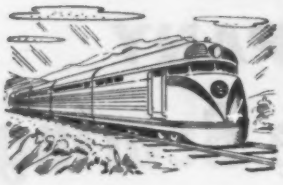
EDWIN S. WOODS & COMPANY Division of

Quality Since 1880

PETTIBONE MULLIKEN CORPORATION

4710 West Division Street, Chicago 51, Illinois

YOUR BOILER "HOUSEKEEPING" IS EASIER WITH APEXIOR NUMBER 1



APEXIOR NUMBER 1 KEEPS METAL SURFACES CLEAN LONGER . . . MAKES MAINTENANCE EASIER . . . RETARDS WEAR

Your first experience with APEXIOR NUMBER 1 on locomotive and stationary boiler shells and other steam-and-water contacting surfaces is a satisfying discovery. Dirt and scale lose their clinging power and come off easily. There is no chemical bonding of scale to metal. Cleaning time is reduced and the work is lighter. Under the surfacing, a few thousandths of an inch thick, the metal is clean and *sound.*

Many years of service experience, on thousands of locomotives subject to Interstate Commerce Commission inspection, show that brush-applied APEXIOR NUMBER 1 coatings penetrate the pores and joints preventing acceleration of stress corrosion or embrittlement due to water contact. APEXIOR NUMBER 1 is recommended by all boiler insurance companies in the United States and Canada.

APEXIOR NUMBER 1 HELPS FEEDWATER TREATMENT

APEXIOR NUMBER 1 is neutral to all standard feedwater chemical treatments and preparations and acts as a supplement to the work of the chemist or water service engineer. It remains stable under boiler water and steam temperatures and pressures.

FOR COLD WATER STORAGE

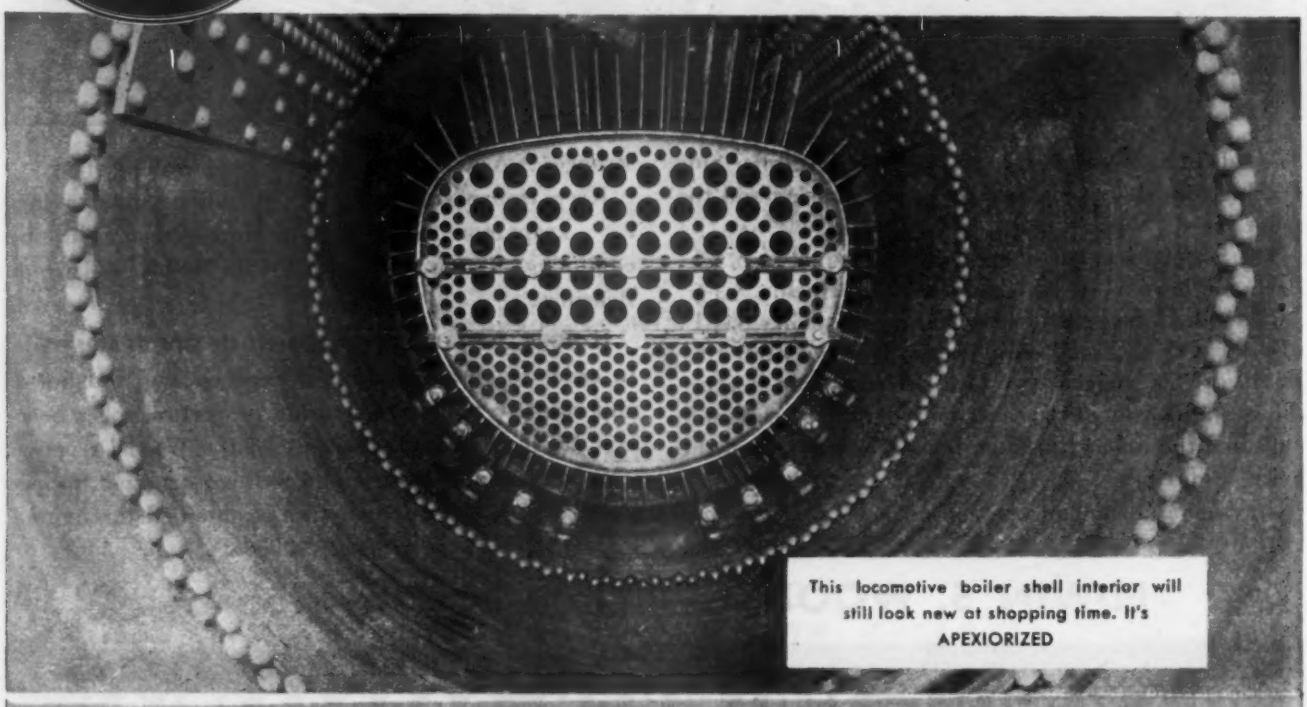
APEXIOR NUMBER 3 protects the water-side of tender cisterns and water storage tanks. It is brush-applied and dries to a jet-black, smooth, shiny surface. It is inert to all boiler-water-treating chemicals and to potable water.

YOU CAN GET APEXIOR

Both APEXIOR surfacing materials are being manufactured in increased quantities to meet the growing demands of industrial power plants, utilities, marine users and railroads throughout the country. Shipments are made every day. Write today for your copy of a bulletin telling how APEXIOR can save metal, time and money for you.

APEXIOR

Keeps new metal new . . . Gives old metal new life



This locomotive boiler shell interior will still look new at shopping time. It's APEXIORIZED

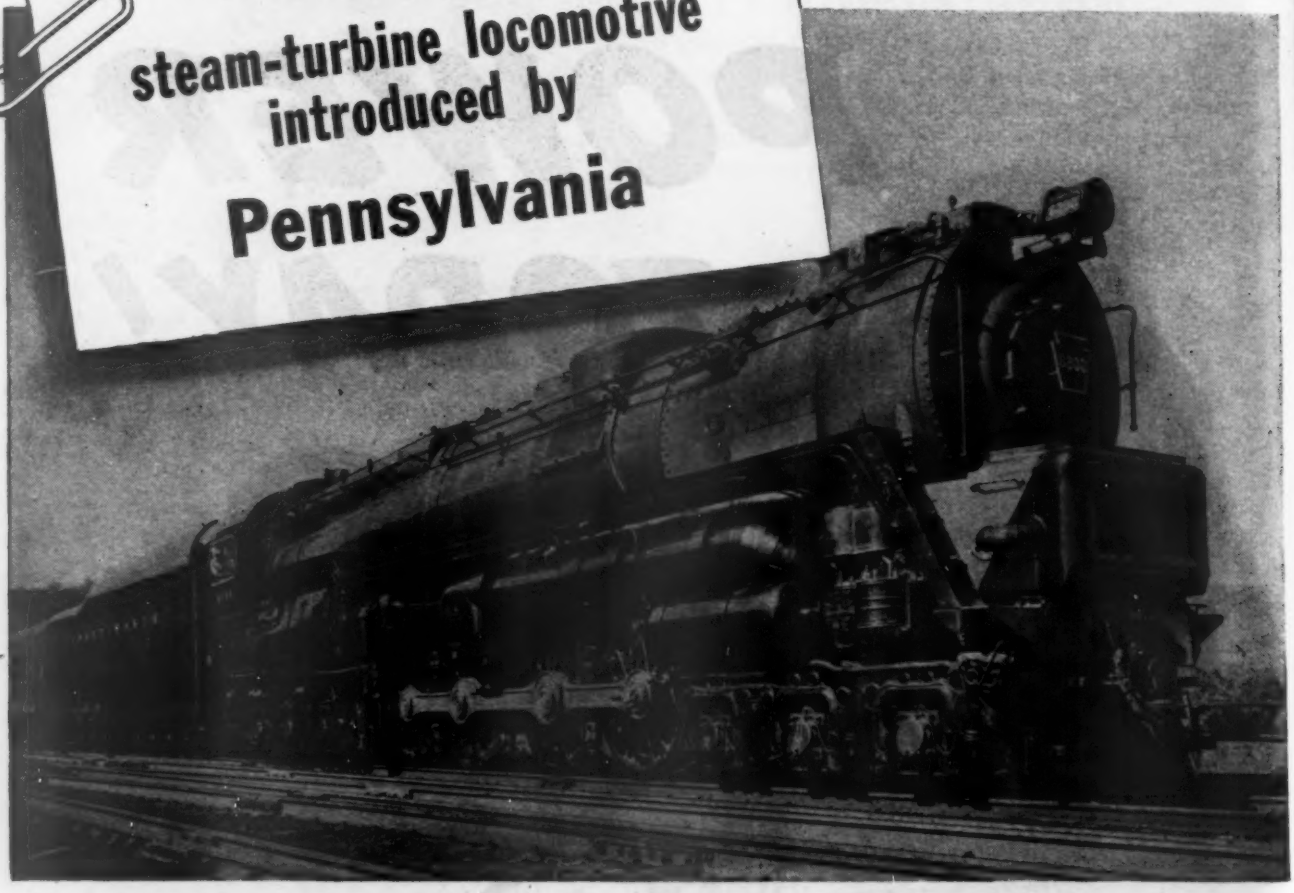
THE DAMPNEY COMPANY OF AMERICA

HYDE PARK, BOSTON 36 MASSACHUSETTS

ATLANTA NEW YORK PHILADELPHIA CHICAGO DETROIT

New type steam-turbine locomotive introduced by Pennsylvania

MORE POWER from a locomotive of given dimensions, smoother operation, higher efficiency, greater availability are a few of the advantages expected from this turbine-driven locomotive equipped with NATIONAL Seamless Boiler Tubes.



RAILROAD men all over the country are showing great interest in the Pennsylvania's new steam-turbine locomotive, the S-2. It represents the most radical change of design in steam locomotives in decades.

For the first time in this country, the high efficiency of the direct-connected steam turbine has been applied to locomotives. The turbine develops 6900 hp. which is transmitted to the driving wheels through double reduction gears. For reversing, a separate turbine is connected to the head pinion through a clutch. Extensive main-line tests are expected to show an improvement in efficiency over reciprocating-engine performance of about 20% more power for the same steam.

The boiler operates at 310 psi. and 750 F. which is not high for modern locomotives. And because one of the design objectives was *maximum* availability, Seamless Boiler Tubes were chosen. Year-in and year-out service in other locomotives has proved the extra long life and dependability of these tubes.

Records show that modern steam locomotives with NATIONAL Seamless Boiler Tubes are capable of operating twice the number of miles per month as steam locomotives built 20 years ago. A steam locomotive operating on a western road made 10 complete round trips in 30 days of 1839 miles each or 18,390 miles—613 miles per day.

For this kind of service, NATIONAL Seamless Boiler Tubes pay out in more time on the rails—less time in repair shop.

WALLS WITHOUT WELDS

NATIONAL TUBE COMPANY

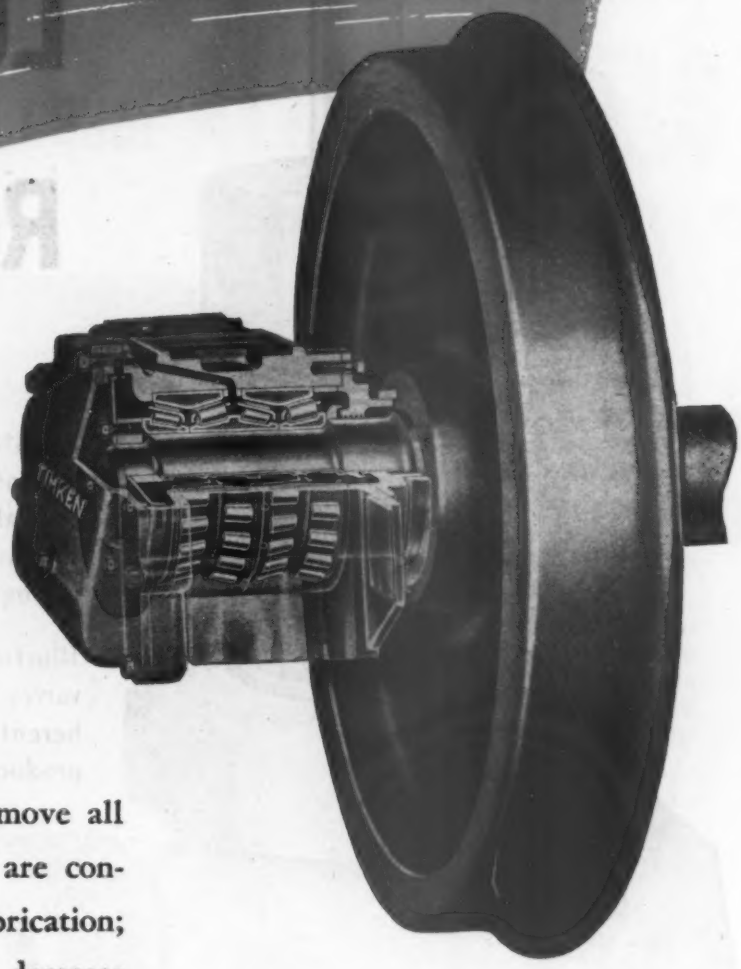
Pittsburgh, Pa.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

NATIONAL TUBE COMPANY USS STEEL UNITED STATES STEEL

UNITED STATES STEEL

For Faster Service



Timken Roller Bearings remove all speed restrictions as far as bearings are concerned; simplify and economize lubrication; increase equipment availability; and decrease maintenance cost.

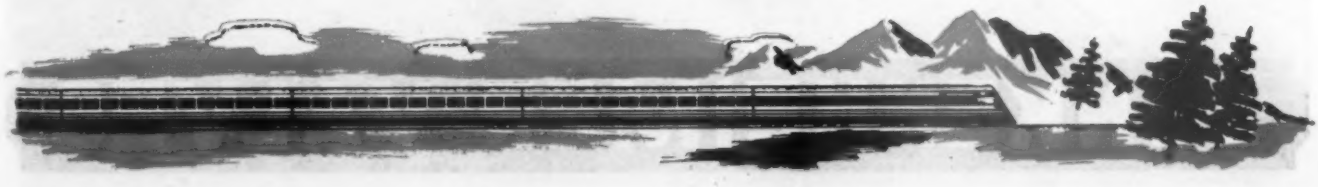
Thousands of Timken Bearings are now in service under passenger equipment cars—including Pullmans and all types of locomotives. Many of these applications have given over 1,000,000 miles of trouble-free service to date. The Timken Roller Bearing Company, Canton 6, Ohio.

Quad Type Timken Roller Bearings for Existing Pedestal Openings.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

RAILWAY ROLLER BEARINGS



FOR LOCOMOTIVE AND ROUNDHOUSE SERVICE

LUNKENHEIMER manufactures a wide variety of products for railroad service requirements . . . valves of bronze, iron and steel; cocks, fittings, unions, air nozzles, boiler mountings and lubricating devices.

Illustrated is one of the several types of A.A.R. valves, made to A.A.R. specifications. The inherent high quality, typical of all Lunkenheimer products, insures maximum safety and long, low-cost service. A Lunkenheimer Distributor is located near you, equipped and ready at all times to help you solve problems of maintenance or operation.

ESTABLISHED 1862

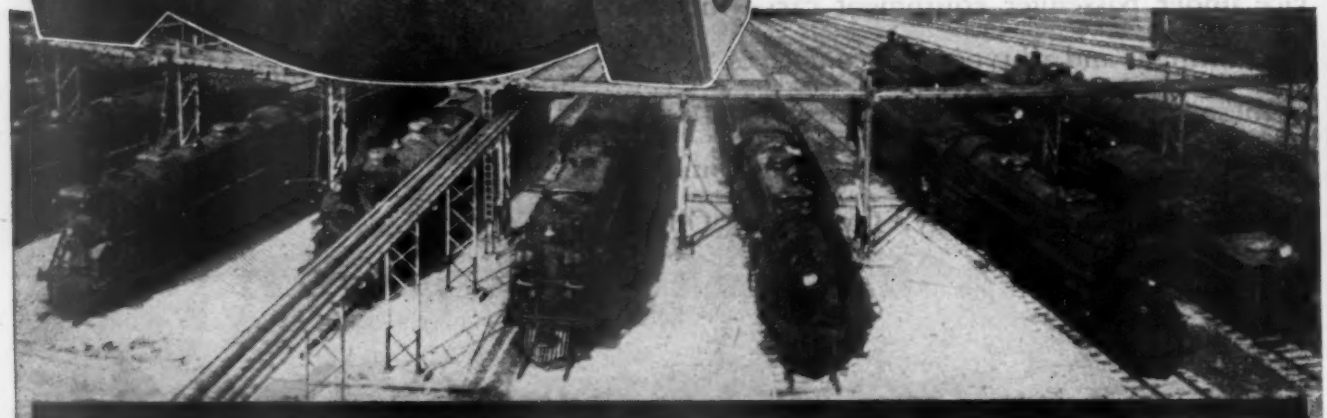
THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO, U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK



LUNKENHEIMER VALVES

FOR SAFETY AT SUB-ZERO TEMPERATURES —no other Material can equal ALLOY STEELS

● When vital parts of railroad equipment—for instance, the locomotive side rods, pins and bolts at the left—must operate *safely* at very low temperatures, you can put your trust in Republic Alloy Steels.

For these top-quality steels possess an inherent and dependable quality of toughness—whether working at red heat or in sub-zero cold.

Alloy steels resist embrittlement due to cold. They protect against crippling and costly failures caused by shock or sudden reversal of stress following weakening of the part by frigid temperature.

And that's only one reason why you should use alloy steels for critical working parts. These steels are unequalled for high strength-to-weight ratio, uniform hardness, fatigue-resistance and corrosion-resistance.

Alloy steels have proved their ability to cut maintenance and replacement costs—to keep equipment out of the shop longer—to increase profits. And Republic—world's leading producer of alloy steels—is ready to tell you how and where to use them to best advantage.

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

Republic
ALLOY STEELS

Also Carbon and Stainless Steels—Sheets—

another star

ARMY ★★ E ★★ NAVY

for MONROE

★ *Easily installed, it fits right in, replacing one of the coil springs in the spring cluster.*

another proof of performance

With reconversion, Monroe's tripled production facilities will make available in even greater quantities the new Monroe Direct-Acting *Hydraulic* Shock Absorber for Freight Car Trucks.

To check progressive harmonic motion . . . control vertical and swaying action . . . to protect lading, equipment and roadbed and reduce maintenance costs and damage claims . . . equip your Freight Car Trucks with this *Hydraulic* Shock Absorber unit. Just write our engineers for specifications and facts.

Patents Make Jobs

MONROE

MONROE AUTO EQUIPMENT CO. . . MONROE, MICH.

INSIDE and OUT

Positive Visual Inspection Assures Greater Dependability in Electrunite Boiler Tubes

Republic ELECTRUNITE Boiler Tubes are made of highest quality flat-rolled steel, cold formed into shape and electrically welded into strong, sound tubing. Thus, the surface which becomes the inside wall of the tube is free from hidden defects, because it is inspected just as closely as the outside surface.

Inside and outside, you are assured of clean, scale-free surfaces throughout every length of Republic ELECTRUNITE Boiler Tubes.

Why? Because ELECTRUNITE Boiler Tubes are cold formed from flat-rolled steel, both sides of which are open to close visual inspection.

But that's not all! There are other reasons why it pays to use Republic ELECTRUNITE Boiler Tubes.

These *modern* boiler tubes speed up retubing. They are free from hard spots—are uniformly high in ductility—because they are full normalized throughout their entire length.

And because they are consistently uniform in wall thickness, diameter and roundness, ELECTRUNITE Boiler Tubes slide in freely, roller expand smoothly and bead over to tight, non-leaking joints in a hurry.

As an added safeguard of uniformly high quality, samples taken at regular intervals during production undergo a rigid testing routine—and every tube is subjected to a hydrostatic pressure well in excess of code requirements before it leaves the factory.

ELECTRUNITE dependability is proved by the fact that more than 150,000,000 feet have been installed in all types of steam generating and heat transfer equipment.

For more information about ELECTRUNITE Boiler Tubes and the Electric Resistance Weld Process by which they are made, write for your copy of our new brochure.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

Southern Pacific Lines

Western Maryland

Reading Lines

Bangor & Aroostook Railroad

Richmond, Fredericksburg and Potomac

Rock Island

Jersey Central Lines

L.V.

N&W Railway

Pullman

Lackawanna Railroad

Pennsylvania Railroad

Illinois Central

Nickel Plate Road

Seaboard Railway — Through the Heart of the South

Cotton Belt Route

The New York New Haven and Hartford Railroad Co.

Delaware and Hudson

Boston and Maine — Modern Transportation

New York Central System

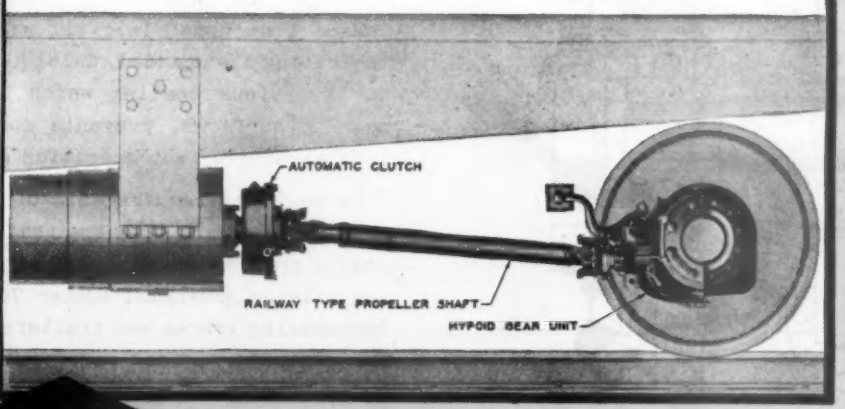
MORE THAN 2000 SPICER *Positive* GENERATOR DRIVES

in operation on 27 different railroads!

Efficiency of operation . . . extremely low upkeep cost . . . and long life—these are advantages being proved by Spicer Positive Generator Drives in constant service on 27 American railroads!

The Spicer Railway Generator Drive for lighting, air-conditioning and refrigerating equipment consists of a very simple application of long-lived hypoid gear and pinion mounted on the standard axle. The drive from the gears is positive and constant through Spicer Universal Joints and Propeller Shaft to the Spicer Automatic Clutch mounted between the generator and the propeller shaft. This automatic clutch completely absorbs all shocks and disconnects the drive line in case of excessive overload, and also completely disconnects the generator drive at speeds below 8 miles per hour, eliminating shock loads when cars are being shunted, also preventing any additional load on the locomotive when starting. It also automatically permits motoring of generator for electrical inspection, and driving of generator by standby motor.

Spicer Positive Railway Generator Drives can be quickly and economically adapted to new designs and reconditioning jobs. Spicer has 42 years of experience available to help you with your individual drive problems—write for further details and literature.



42 YEARS OF Spicer SERVICE

Positive GENERATOR DRIVES

Manufactured, Sold and Serviced by

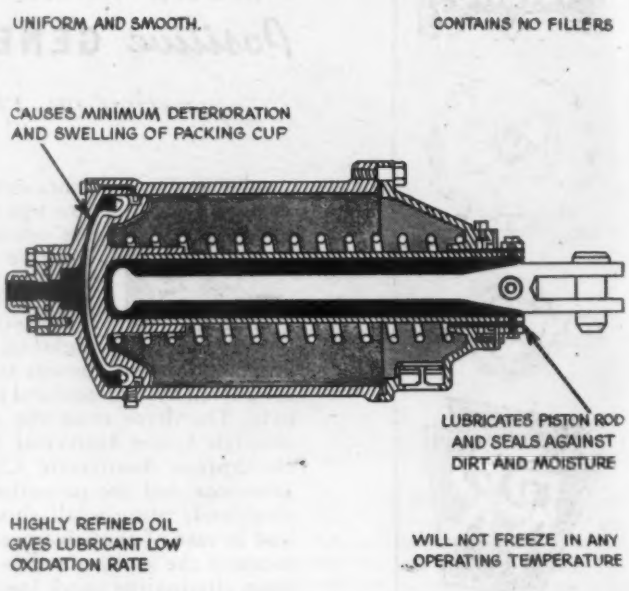
Spicer Manufacturing Corporation, Toledo, Ohio

Brake cylinder lubricant meets all A. A. R. specifications

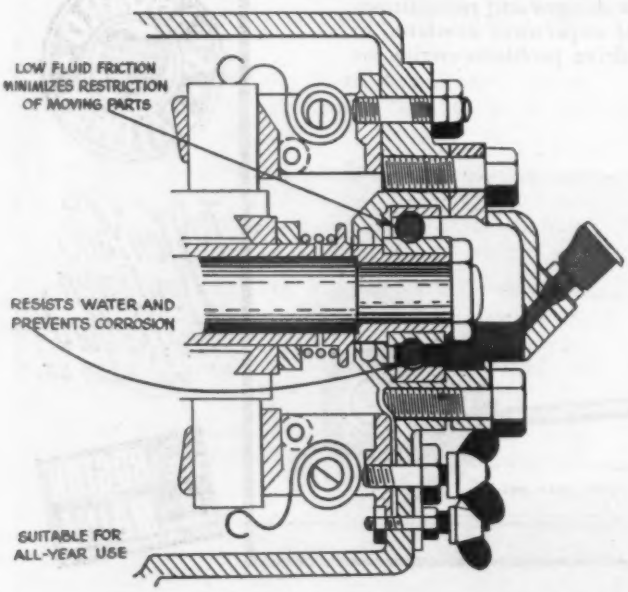
Developed by California Research Corp., a Standard of California subsidiary, with the cooperation of air brake manufacturers, every specification of Calol Brake Cylinder Lubricant is as high or higher than those adopted as ideal by the A. A. R.

Resisting separation, Calol Brake Cylinder Lubricant minimizes packing-cup deterioration. In separation tests, where lubricant is left on a 6-mesh screen at 175° F. for seven days, it does not melt or bleed. It will not freeze or become solid at specified below-zero temperatures. It still works and stirs easily at minus 40° F.

Calol Brake Cylinder Lubricant contains more than 85% highly refined mineral oil with a Saybolt viscosity of about 700 seconds at 100° F. It will not harden with age or exposure. Always uniform, it fully meets worked and unworked consistency requirements in A.S.T.M.-method penetrometer tests.



Rust-inhibited oils stop bearing corrosion trouble



Free operation at all times of ball- and roller-bearings in locomotive headlight generators, feed-water pumps, driving journals and other parts equipped with bearings of this type, is assured with Calol R-I Bearing Oils.

Made from paraffinic oil with a special rust-inhibiting agent added, Calol R-I Bearing Oils form an impervious coating which bars moisture from bearing surfaces, prevents corrosion when water from washing or wet operation enters housings.

To meet the requirements of different service, Calol R-I Bearing Oils are available in three viscosity grades: Number 150, heavy, for roller-bearing driving journals; Number 70, medium, for roller-bearing trucks and trailers; Number 15, light, for generators, feed-water pumps and other units using high-speed ball- and roller-bearings.

There is a Calol Product to meet every industrial lubrication problem. For information, write Standard of California, 225 Bush Street, San Francisco 20, California.

STANDARD OF CALIFORNIA

DZUS* SPIRAL CAM FASTENERS ARE RUGGED

The Dzus Fasteners used to fasten the ceiling panels illustrated in this picture are designed to meet this specific requirement of the railroad industry. Strong, vibration proof, easy to operate and long lived — these fasteners will help to reduce man-hours in repairing and maintaining rolling stock.

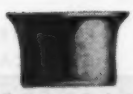
Pyle-National Multi-Vent system on the modern Missouri Pacific "Eagle" has 440 Dzus spiral cam fasteners in the ceiling panels. Note lowered panel showing convenient access to plenum chamber.

Dzus spiral cam fasteners are made in different sizes and types to fit every requirement. They have solved many tough fastening problems in the railroad industry. Write today for your copy of the Dzus catalog.

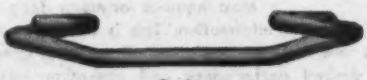
*The word DZUS is the registered trade mark of the Dzus Fastener Co., Inc.

DZUS FASTENER CO., INC.
BABYLON NEW YORK
IN CANADA: RAILWAY AND POWER ENGINEERING CORP., LTD.

Fastener Stud



Gromet

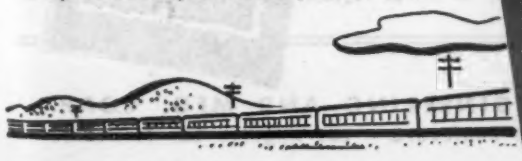


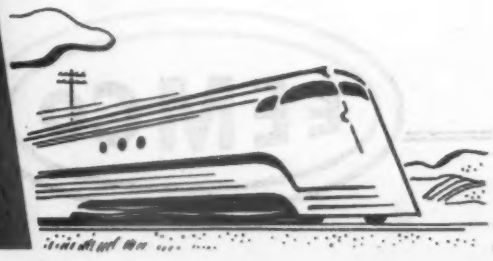
Spring

Complete assembly of the Dzus spiral cam fastener

TYPICAL DZUS APPLICATIONS

Thermostat support assemblies.
Water tank casing.
Light fixtures in air diffusers.
Thermostat access door frame assembly.
Filter trap door.
Air-conditioning unit trap door.
Trap door in men's lounge to replace removable panels.
False ceiling structure in front end of barber shop and men's lounge car.
Trap door assembly and ceiling assembly.
End sheet and door assembly for water tank casing assembly.
Multi-vent panels for air-conditioning.
Hinged ceiling lights in passenger cars.





Another New Type Pennsylvania Locomotive—

26 Fast Freight 4-4-6-4's Are Equipped With These COMMONWEALTH Devices:

- Locomotive Beds
- 4-Wheel Engine Trucks
- 4-Wheel Trailer Trucks
- Boxpok Driving Wheels
- Waterbottom Tender Frames
- 8-Wheel Tender Trucks

This new fleet of modern locomotives joins the many others using COMMONWEALTH One-Piece Cast Steel Devices to—simplify locomotive construction—reduce maintenance and upkeep costs—*increase locomotive availability.*

One-Piece Bed with 4-Cylinders Cast Integral

GENERAL STEEL CASTINGS

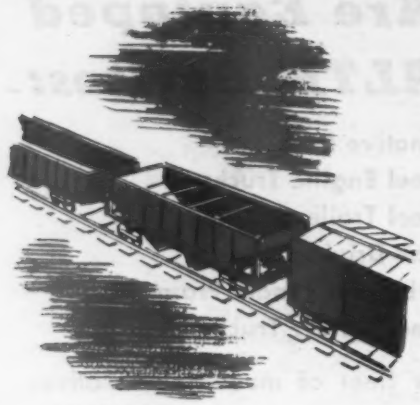
EDDYSTONE, PA. GRANITE CITY, ILL.

Select the Weight-Saving Steel which meets your *Specific* needs from *Republic's*

3 HIGH STRENGTH STEELS

REPUBLIC ALDECOR ★ REPUBLIC COR-TEN

REPUBLIC DOUBLE STRENGTH



To simplify your weight reduction problems, Republic now offers a COMPLETE LINE of *three* different High Strength Steels—ALDECOR, COR-TEN and DOUBLE STRENGTH.

While these three low alloy steels are quite similar, they differ somewhat in chemistry, and in forming and welding characteristics. That is why Republic — following its basic policy of providing a wide range of steels and steel products for practically every need of industry—produces all three steels.

In widespread use for more than a decade, COR-TEN and DOUBLE STRENGTH STEELS already have proved themselves as dependable, low cost, weight saving materials. ALDECOR, although a newcomer in the field, possesses forming and welding qualities which should enable it to surpass its companions in certain types of applications.

From a physical standpoint, all three steels possess a minimum yield strength of 50,000 p.si. They provide comparable resistance to atmospheric corrosion . . . and, in abrasion resistance, they are equal to carbon steels of like physical properties. In bars, plates, sheets and strip, all three may be worked and welded readily.

To aid you in selecting the high strength analysis which is best adapted to your needs, Republic offers you the wholehearted cooperation of its seasoned metallurgical staff. These specialists, with long experience in the application of weight saving steels to transportation equipment and other types of machinery, are ready to work with you NOW.

Write for folder No. 434.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Bldg., New York 17, N. Y.

Republic

HIGH STRENGTH STEELS

ALDECOR • COR-TEN • DOUBLE STRENGTH

Other Republic Products include Carbon, Alloy and S[illegible] Steels — Sheets — Plates — Pipe — Spring Bolts, Nuts and Rivets — Electric Resistance Tubes

Again,

The above car is one of a lot of 2,000 recently built, equipped with Barber Stabilized Trucks.

The continued use of Barber Stabilized Trucks by so many railroads on their new freight cars can mean only one thing — *Satisfactory Service* under today's faster speeds and heavier loads. These trucks are designed and built to absorb shocks under all load conditions; the friction resistance between friction casting and wear plate IS NOT A FIXED PRESSURE but is at all times in correct proportion to the load.

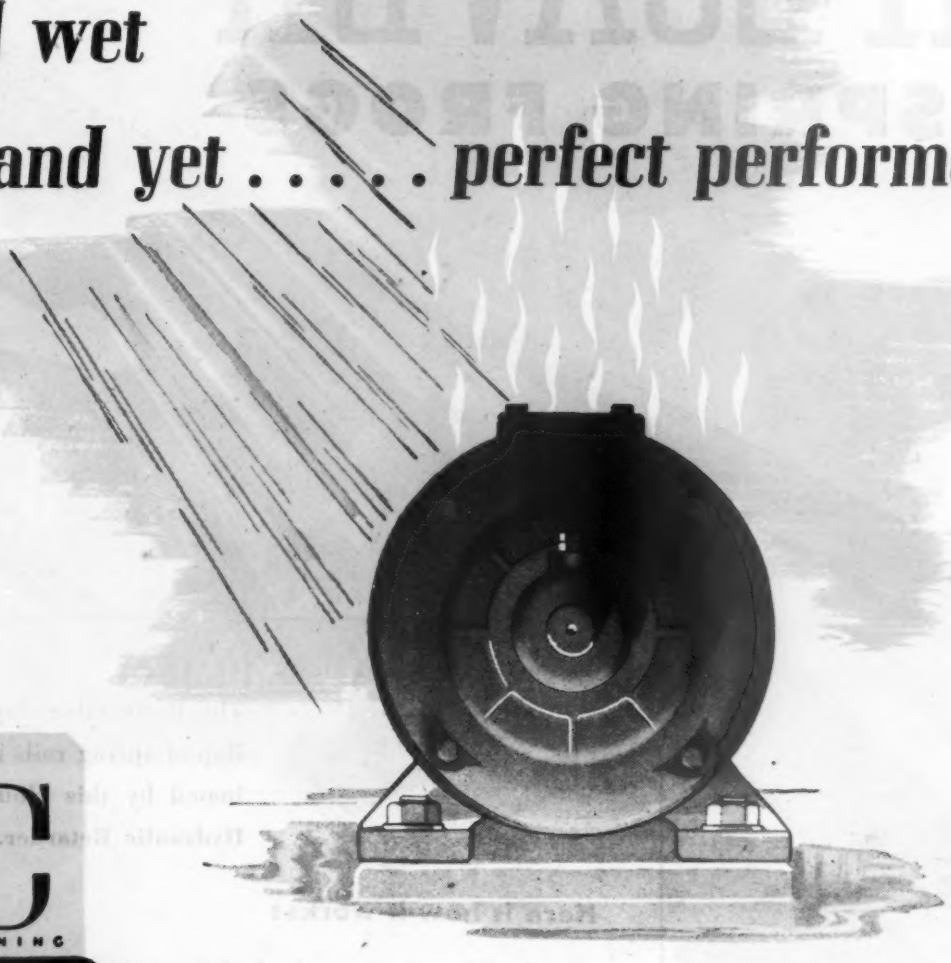
BARBER STABILIZED TRUCKS Mean Satisfaction Today, Preparedness for Tomorrow.

A spring grouping with 2½" travel can be substituted for A.A.R. Springs if desired.

Selected for over 95,000 cars by 55 different Railroads and Private Car Lines.

STANDARD CAR TRUCK COMPANY
332 SOUTH MICHIGAN AVENUE CHICAGO, ILLINOIS

Sweated and wet and yet . . . . . perfect performance



DOW CORNING VARNISHES
TRADE-MARK

high → temperature silicone insulation

Humidity, arch foe of conventional insulation, finds its conqueror in Dow Corning 993—the revolutionary new heat stable silicone varnish. Under extreme thermal conditions, DC 993 definitely excludes water and other conducting materials because it remains flexible and does not crack or carbonize.

Perfect performance of motors and other electrical equipment is assured in normal or overload operation. The combination of heat and moisture resistance in DC 993 enables greatly extended operation at temperatures of 175° to 200° C., alternating with idle periods and conditions of extreme humidity.

USE DC 993 . . .

to impregnate motor stators, transformer coils and other non-rotating coils; to varnish Fiberglas and other asbestos served magnet wire; to varnish Fiberglas, mica and asbestos, insulating cloths, tapes, sheets and sleeving.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN
ADDRESS ALL INQUIRIES TO BOX 592

Dow Corning
FIRST IN SILICONES

LIFESAVER
for SPRING FROGS

The destructive slap, slap, slap of spring rails is eliminated by this Houdaille* Hydraulic Retarder.

Here is how it works:

1. When the first wheel of the train presses through the frog, the Retarder permits the spring rail to open without resistance.

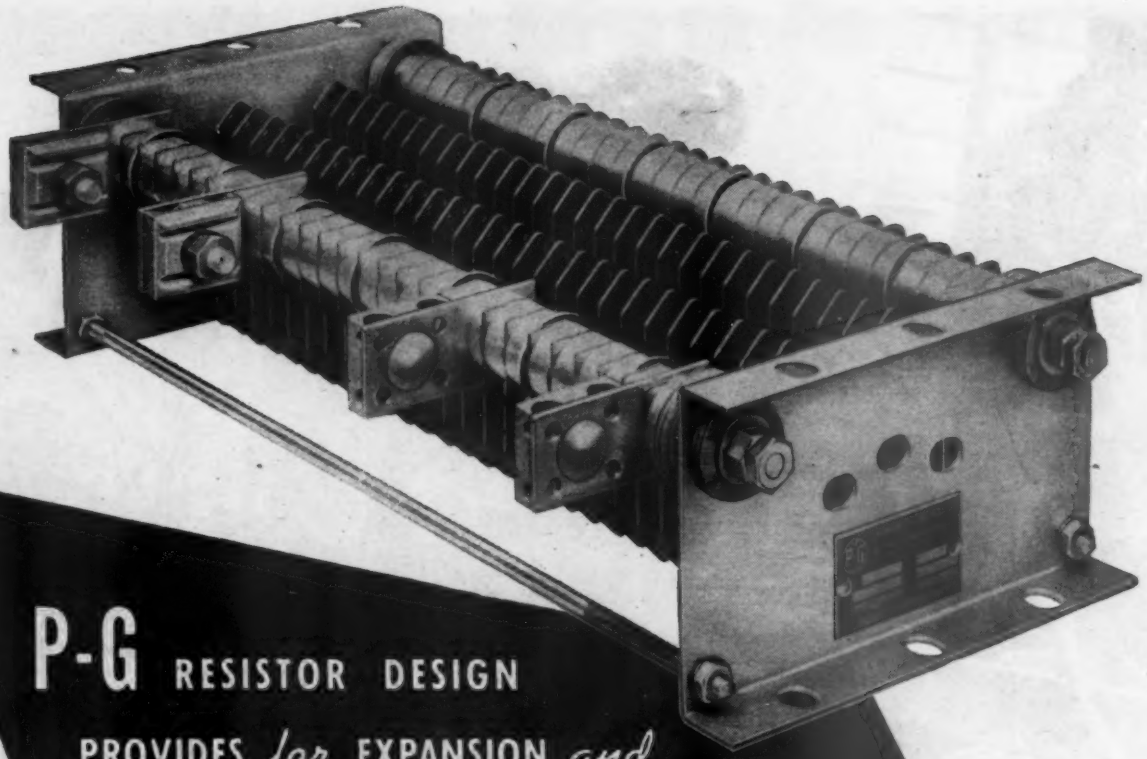
2. The instant the wheel pressure is released, the Retarder imposes a steady, controlled resistance, delaying the closing of the spring rail until the last wheel has passed through the frog.

3. The spring rail then closes slowly. All resistance ceases when the rail nears its closed position so that it snaps freely into place.

On train, on track, Houdaille Railway hydraulic installations have established an impressive record of performance. We invite the industry to draw upon our engineering experience.

HOUDE ENGINEERING DIVISION OF
HOUDAILLE-HERSHEY CORPORATION
MAKERS OF HYDRAULIC CONTROLS
BUFFALO 11, NEW YORK

*Pronounced—Hoo-dye



P-G RESISTOR DESIGN PROVIDES *for* EXPANSION *and* MAXIMUM VENTILATION . . . .

- ★ ALL STEEL CONSTRUCTION
- ★ MICA INSULATION
- ★ RUGGED TERMINALS
- ★ PROVISION FOR EXPANSION
- ★ ADEQUATE VENTILATION
- ★ UNAFFECTED BY VIBRATION
- ★ MOISTURE RESISTANT
- ★ CORROSION PROTECTED

• The exclusive "P-G Floating Bolt" construction permits the resistor element to expand without buckling as the temperature increases under load. Thus, damage from expansion or buckling . . . a frequent source of resistor trouble . . . is eliminated.

The unique shape of the "P-G Steel Grid" assures maximum ventilation because of the even heat distribution over the entire grid surface. Each part of the grid is equally exposed to air and the heat produced is rapidly dissipated.

These and many other practical features of design, plus steel and mica as basic materials, assure long resistor life.

Detailed information in BULLETIN No. 500

Copy on request

P-G

The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO

Photo courtesy Erie Railroad Company

Air hose made from HYCAR will last longer, lower maintenance, save money

AIR HOSE is a good example of why Hycar synthetic rubber is an ideal material for many uses in the railroad industry.

The picture shows the kind of treatment air hose gets. It has to be tough. And hose made from Hycar will resist abrasion 50% better than hose made from natural rubber. Air passing through the compressor picks up oil and carries it into the hose. Oil destroys natural rubber. Yet Hycar is practically unaffected by oil and grease, even at high temperatures. Air hose is used in all kinds of weather. Unlike natural rubber, Hycar strongly resists the action of sun and aging, and remains virtually unchanged over a wide range of temperatures.

All this can be directly translated into actual savings of money through longer life and lower maintenance costs—not only of hose but of gaskets and seals of all kinds, mountings and bushings, mats and flooring, vibration dampeners, sealing strips, and many other items.

Examine the list of properties in the box at the right, keeping in mind the requirements of your rubber parts. Then, *ask your supplier for parts made from Hycar.* Test them in your own applications—difficult or routine. You'll learn for yourself that Hycar can help you reduce operating costs—that it's wise to use Hycar for long-time, dependable performance. *Hycar Chemical Company, Akron 8, O.*

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. *EXTREME OIL RESISTANCE—insuring dimensional stability of parts.*
2. *HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. hot oil.*
3. *ABRASION RESISTANCE—50% greater than natural rubber.*
4. *MINIMUM COLD FLOW—even at elevated temperatures.*
5. *LOW TEMPERATURE FLEXIBILITY—down to —65° F.*
6. *LIGHT WEIGHT—15% to 25% lighter than many other synthetic rubbers.*
7. *AGE RESISTANCE—exceptionally resistant to checking or cracking from oxidation.*
8. *HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.*
9. *NON-ADHERENT TO METAL—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)*

Hycar

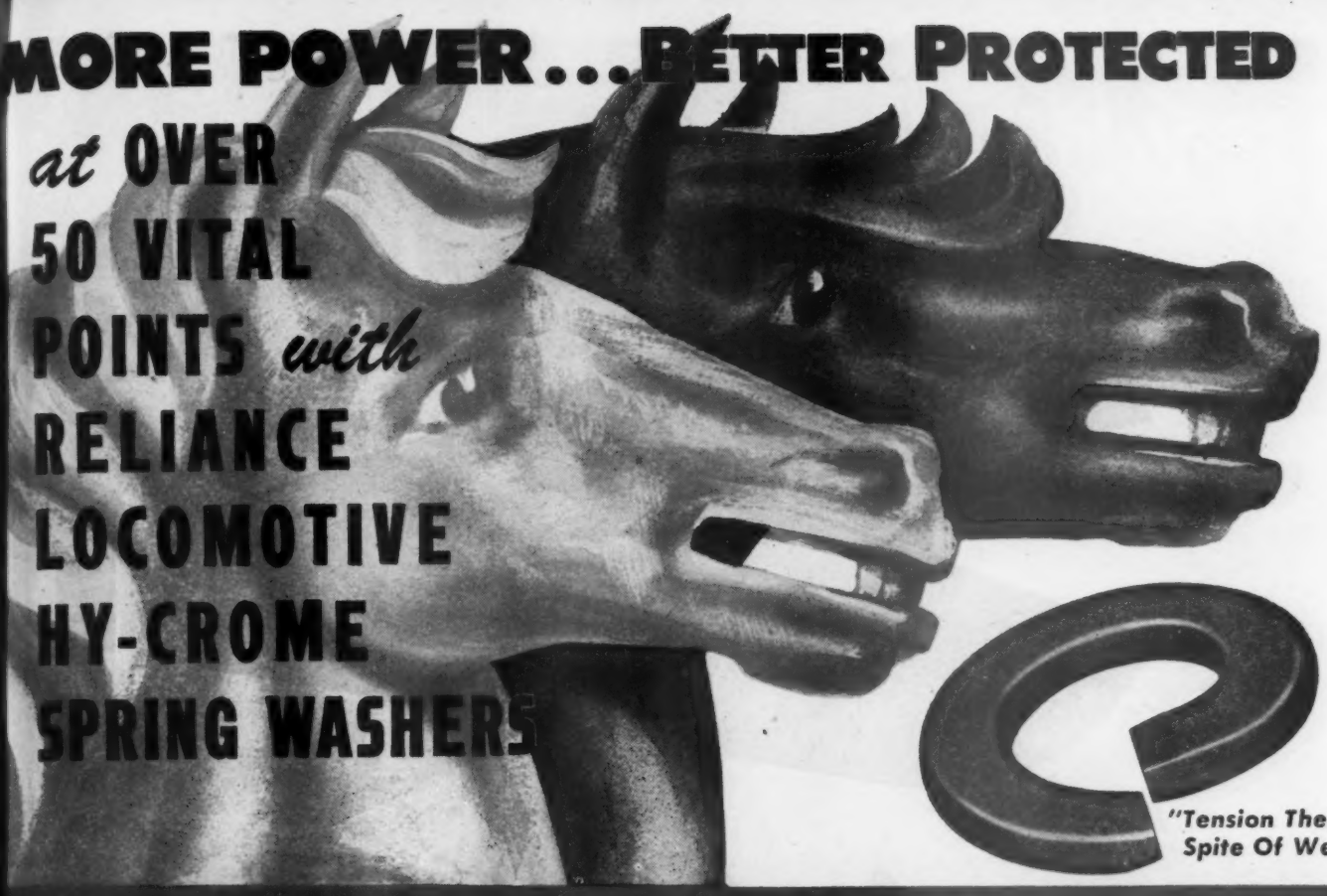
Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubbers

MORE POWER... BETTER PROTECTED

at OVER 50 VITAL POINTS *with* RELIANCE LOCOMOTIVE HY-CROME SPRING WASHERS



"Tension There In Spite Of Wear"

Equipped with Reliance Locomotive Hy-Crome Spring Washers.

AMERICAN LOCOMOTIVE COMPANY
NEW YORK

Class, 600-DL-2B3 — 2000 H. P. Diesel Locomotive — Road Number, 0752

BUILT FOR THE NEW YORK, NEW HAVEN & HARTFORD.

WEIGHT IN POUNDS WORKING ORDER		2-1000 H. P. DIESEL ENG. Turbo-charged (Buchi System)			MOTORS				GAUGE OF TRACK
Total	Driving Wheels	Cylinders	Diam.	Stroke	Type	Number	Gear Ratio	Suspension	
357500	238000	6	12½"	13"	GE. 728-B	4	[illegible]	Spring Nose	4'-8½"

CAPACITY ROAD SERVICE			WHEEL BASE		
Tractive Effort—Pounds	Speed—M. P. H.		Driving	Rigid	Total
59500	Starting		58'-4"	15'-6"	58'-4"
25100	23	Continuous	WHEEL DIAM.		AXLES
	80	Max. Speed	Driving	Idler	Driving: Journal — Center
			40"	40"	Timken Bearing 7" — 9"

Locomotive Hy-Crome Spring Washers are fabricated to specific requirements for bolt size ranging from ¼ inch to 2 inches.

Many leading American railroads including the New York, New Haven and Hartford are finding, through the use of Locomotive Hy-Crome Spring Washers at assembly points on Locomotive and rolling stock, an economical and efficient method of maintaining tight nuts, bolts and assembled parts on their equipment.

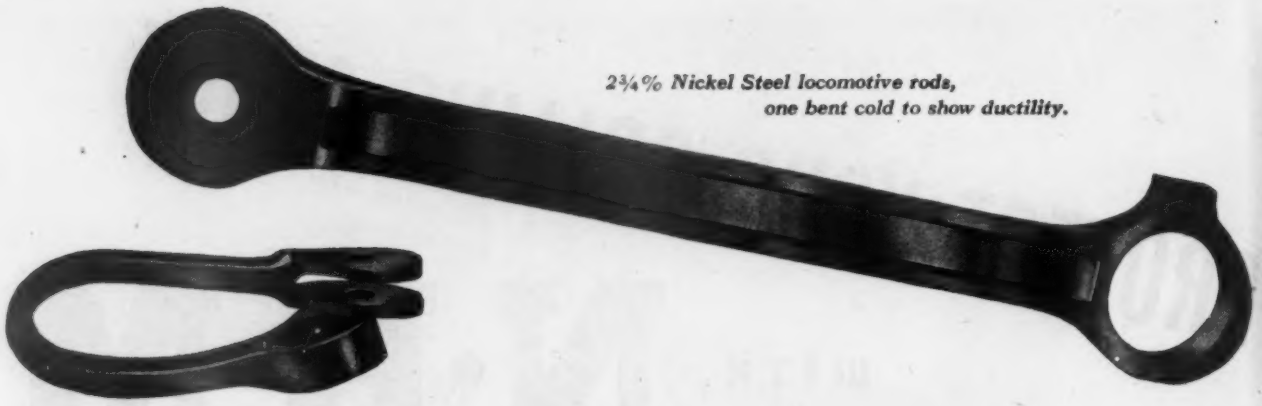
Locomotive Hy-Crome Spring Washers, when compressed, exert the right Spring Power to give the correct bolt tension. This provides a constant thrust to compensate for inevitable looseness resulting from wear.

Write Today for our Motive Power Folder giving important information on the Hy-Crome Spring Washer Family, also for our sheet listing over fifty applications of Locomotive Hy-Crome Spring Washer usage on Motive Power.

EATON
EATON MANUFACTURING COMPANY
MASSILLON, OHIO

Reliance Division

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal



2¾% Nickel Steel locomotive rods, one bent cold to show ductility.

QUENCHED AND TEMPERED NICKEL STEEL FORGINGS COMBINE

EXCEPTIONAL DUCTILITY WITH HIGH TENSILE STRENGTH

Composition and Typical Properties of Normalized Quenched and Tempered 2¾% Nickel Steel Rods

Description or Size	Melt Yield Pt. No. Lbs. per Sq. In.	Tensile Strength Lb. per Sq. In.	Elong. % in 2 In.	Reduction in Area %	ANALYSIS					
					Car.	Mang.	Phos.	Sul.	Sil.	Ni
Main Rod....	92900	110000	25.0	64.4	.31	.78	.027	.026	.25	2.75
Main Rod....	86500	104500	25.5	65.6	.32	.86	.034	.032	.29	2.69
Main Rod....	86360	104400	26.0	64.8	.32	.86	.034	.032	.29	2.69
Main Rod....	87850	102350	26.0	66.2	.31	.89	.037	.025	.32	2.69
Front Rod....	96000	102250	25.0	67.3	.29	.82	.035	.027	.24	2.71
Front Rod....	83900	104250	25.0	66.1	.29	.82	.035	.027	.24	2.71
Front Rod....	86850	104250	27.0	66.1	.32	.86	.035	.025	.30	2.65
Front Rod....	89500	107050	25.5	65.6	.32	.86	.035	.025	.30	2.65
Back Rod....	89500	107650	25.0	62.7	.30	.79	.030	.025	.22	2.71
Back Rod....	87500	106450	25.0	65.4	.29	.82	.035	.027	.24	2.71
Back Rod....	87000	105600	25.0	65.4	.29	.82	.035	.027	.24	2.71
Back Rod....	88150	104850	26.0	66.8	.29	.82	.035	.027	.24	2.71

Specimens Taken from Mid-Section of Prolongations of the Forgings

The above table compiled by the American Locomotive Company shows the chemical compositions and mechanical properties of some normalized, quenched and tempered nickel steel front, main and back rods recently produced as replacement rods for locomotives being speeded up and rebalanced. These values are typical of replacement rod forgings recently tested by that company.

Quenched and tempered nickel steel forgings of this type provide high tensile strength and ductility, combined with unusual toughness and high fatigue strength—qualities which tend to obviate breakage when employed as rods in railroad service.

A booklet entitled, "NICKEL ALLOYS IN RAILWAY EQUIPMENT," describes important and varied uses of nickel steels and other alloys of nickel. Send for your copy today.

★ Nickel ★

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

. . . when it's RAILROAD PINS and BUSHINGS!

CAPACITY means a big machine tool equipment list . . . and WE have it! For instance, centerless grinders. Thirty-five of the very latest type machines up to 6″ diameter. Six-spindle automatics? Exactly thirty-eight, in sizes from 1″ to 3½″ bar stock. Thread mills? Thirty-two. Turret lathes? Sixty-three. And so on. Everything to facilitate a complex job is at our command *and yours*. The most modern inspection equipment . . . including electrically controlled heat treat, carburizing, nitriding. Plus skilled manpower and engineering brains to complete the picture. That's why we thrive on big volume assignments in the precision parts business. For quick action on your pins-and-bushings problem, write our Executive Sales Offices. We'll send, too, an impressive brochure on our plant equipment and facilities.

That's Why — . . . . API . . . .

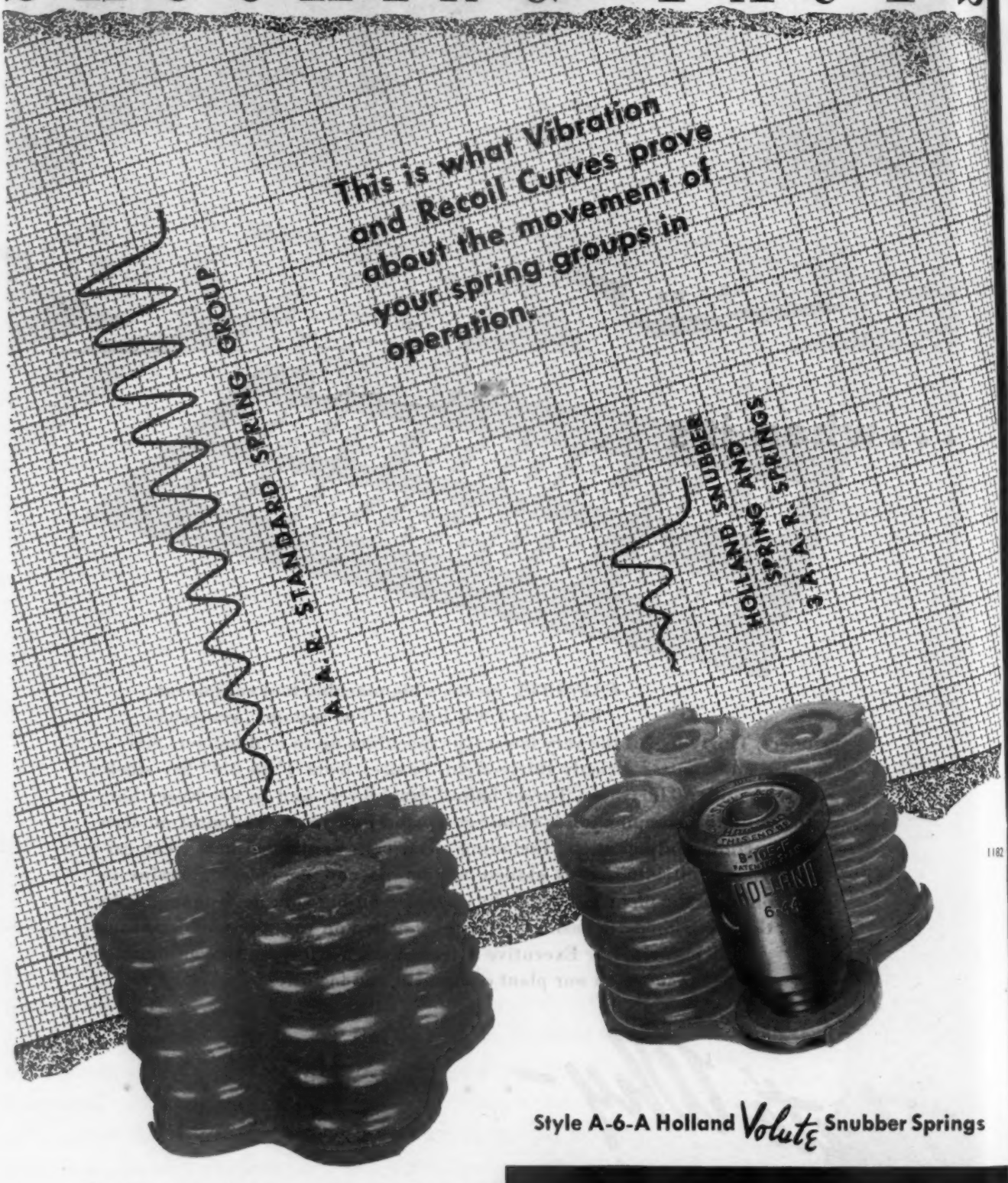
"IT'S A JOB FOR AERONAUTICAL PRODUCTS"

AERONAUTICAL PRODUCTS, INC.

Detroit Plant and Administrative Offices: Detroit 12, Michigan

Ohio Plant: Washington Court House, Ohio

SHOCKING FACTS



Style A-6-A Holland *Volute* Snubber Springs

HOLLAND COMPANY

332 SOUTH MICHIGAN AVENUE, CHICAGO, ILLINOIS

Here is one item of "overhead expense" that is easy to reduce . . . running board repair costs.

The records of one user, who was getting an average of 5 years of service life from untreated running boards, showed an annual cost per car of about $2.50.

At this rate 15 months of added life will defray the cost of preservation treatment. From then on the pressure-treated running boards on each car will reduce "overhead expense" by approximately $2.50 per year plus whatever the cars will earn during the time which would otherwise be spent in shops for repairs or replacements. And remember, pressure-treated running boards last a long time. Inquiries are invited.

KOPPERS COMPANY, INC.—WOOD PRESERVING DIVISION
PITTSBURGH 19, PA.

Buy War Bonds—
and Keep Them!

KOPPERS

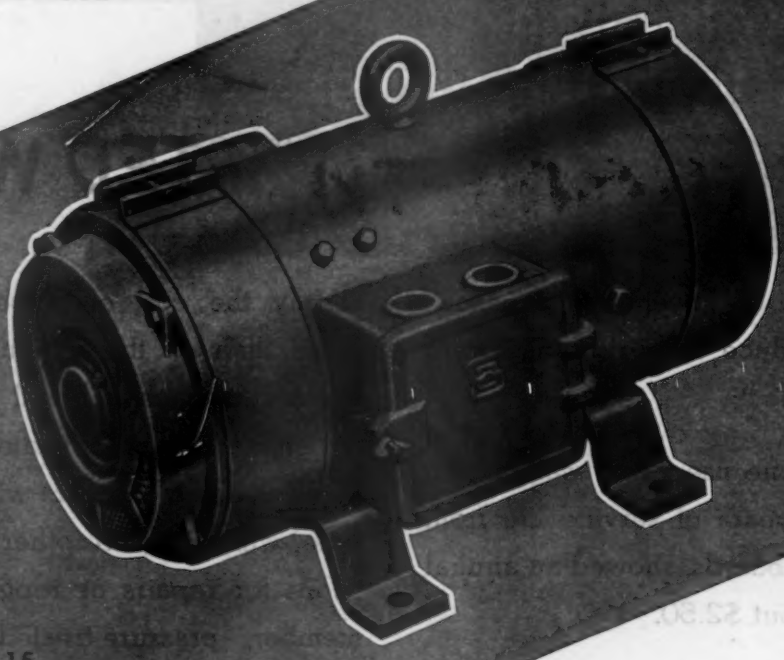
THE INDUSTRY THAT SERVES ALL INDUSTRY

A Constant Level of Illumination With Fluorescent Lamps is Desirable

By keeping voltage and frequency variations within reasonable limits for all values of DC input voltages, a constant level of illumination is maintained.

This greatly enhances the advantages of Fluorescent Lighting, and assures maximum lamp life.

INHERENT VOLTAGE AND FREQUENCY REGULATION



TYPE MG-15
MOTOR ALTERNATOR

Since the first application of Fluorescent Lighting to a railway car, the SAFETY Motor Alternator has been the accepted standard means of conversion from DC to AC.

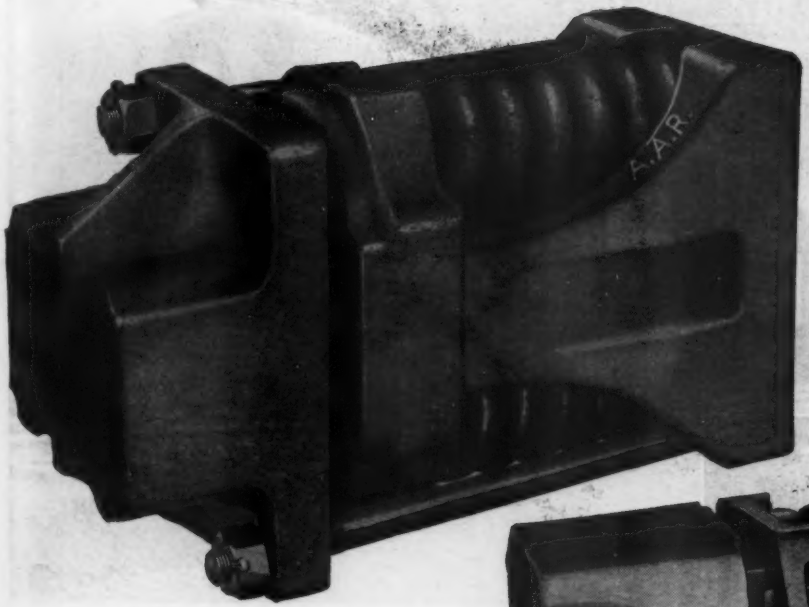
THE SAFETY CAR HEATING and LIGHTING COMPANY, INC.
NEW YORK - CHICAGO - SAN FRANCISCO - PHILADELPHIA - BOSTON - ST. LOUIS - MONTREAL

NATIONAL FRICTION DRAFT GEARS

Smooth Action

•

Maximum
Shock Absorption



NATIONAL M-17-A DRAFT GEAR
22⅜" long
A.A.R. Approved

NATIONAL M-50-B DRAFT GEAR
20⅛" long
A.A.R. Approved

Long Life

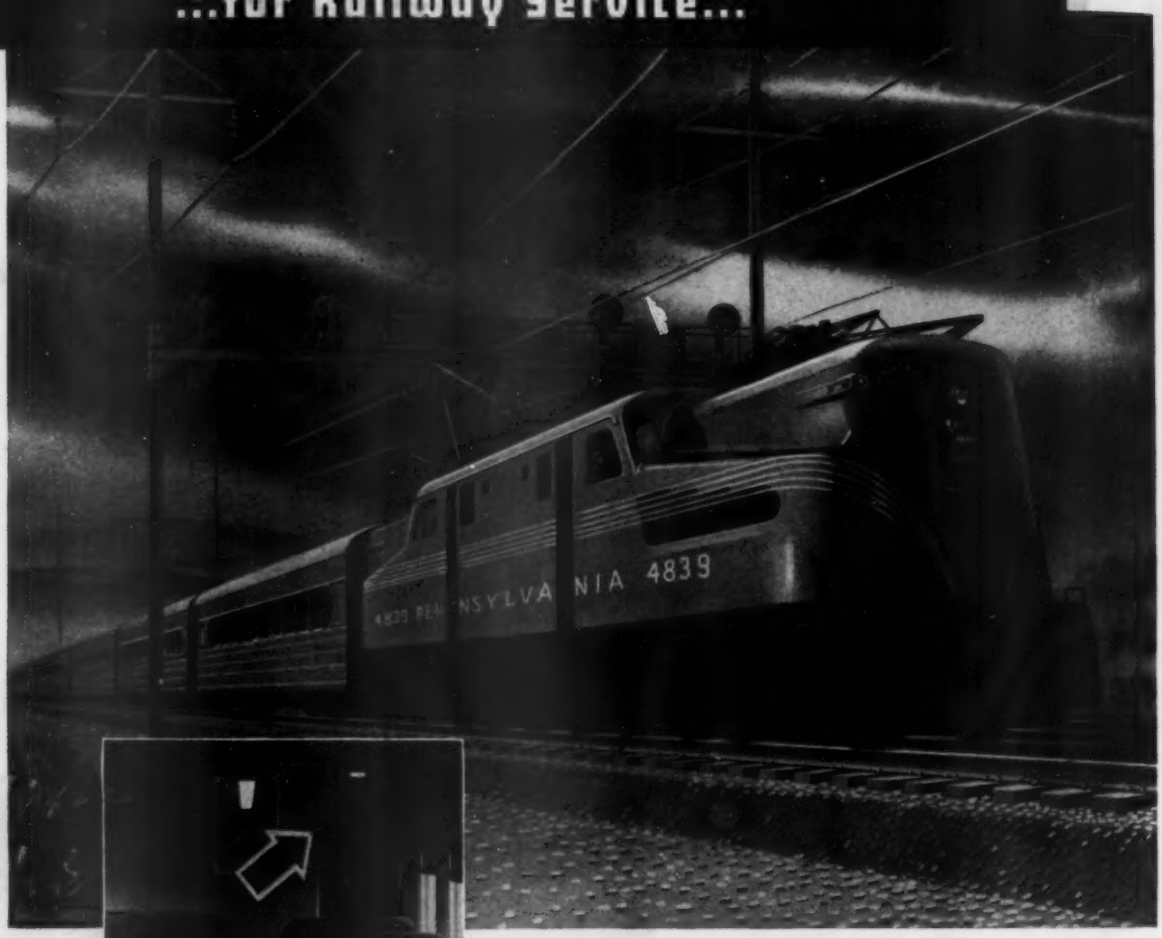
Low Maintenance

High Protective Capacity

NATIONAL MALLEABLE AND STEEL CASTINGS CO.
General Offices: CLEVELAND, OHIO
Sales Offices: New York, Philadelphia, Chicago, St. Louis, San Francisco
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill.

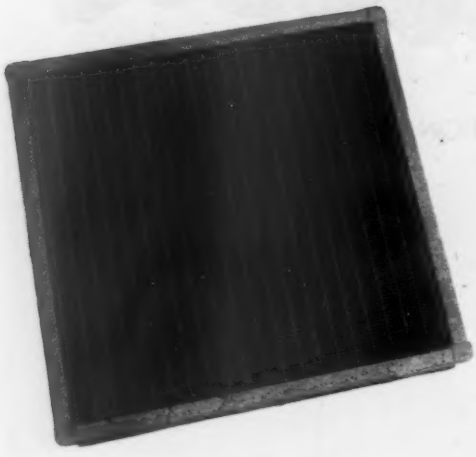
BARBER-COLMAN GRILLES

...for Railway Service...



Passageway view shows the location of the Barber-Colman Return Air Grille.

PENNSYLVANIA'S STREAMLINED TRAIL BLAZER USES *uni-flo* GRILLES



The Barber-Colman Return Air Grille used in the Pennsylvania *Trail Blazer* coaches. Note the fin construction and support bars. The unit is rigid, rattleproof, and easy to clean.

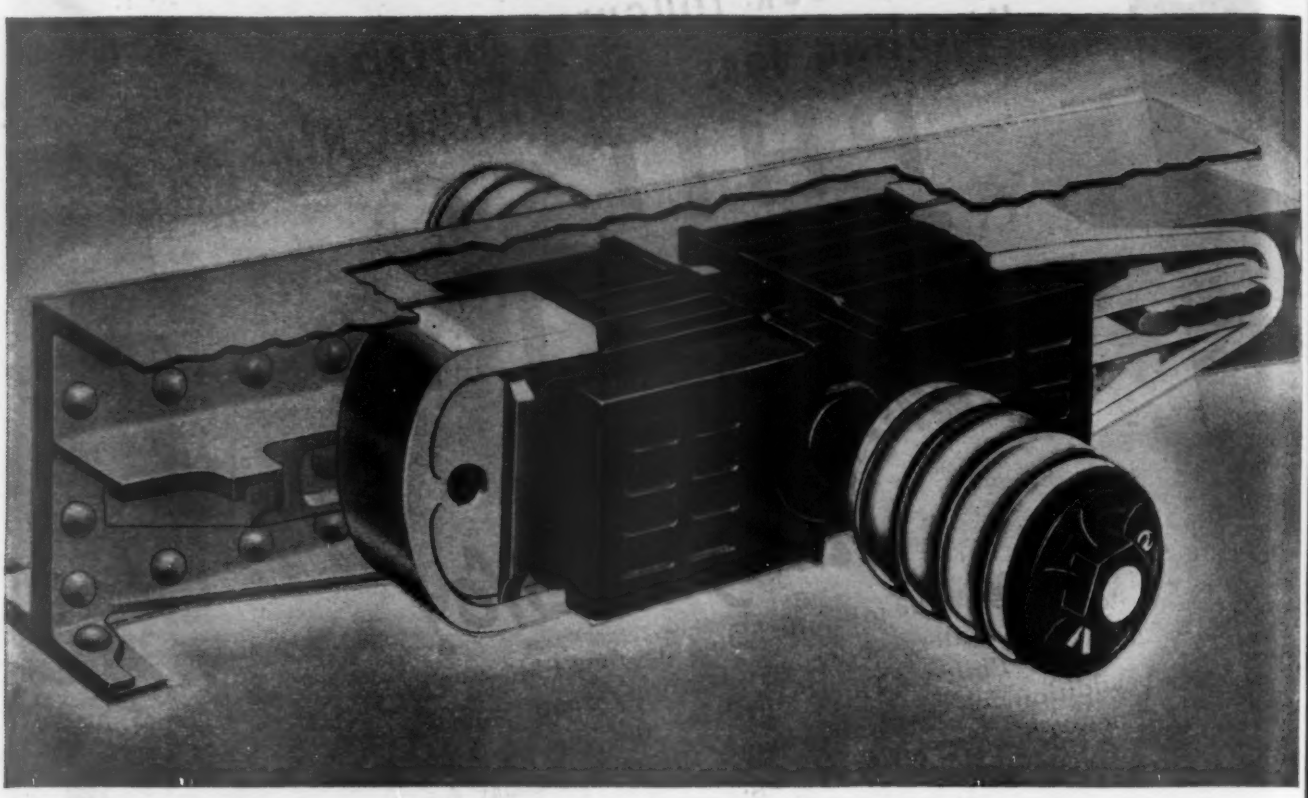
AN important item in the air conditioning system on the coaches of the Pennsylvania Railroad's popular Trail Blazer is the Barber-Colman return air grille. It is located in the passage as shown. The unit is fabricated with an integral filter box, hinged so that it can be conveniently cleaned, and filters replaced when necessary. Barber-Colman UNI-FLO Railway Grilles are fabricated of sheet steel. The core construction is rigid. The fin strips are folded and have pressed-in support bars to give a firm interlocking assembly. Write for data.

BARBER-COLMAN COMPANY
Rockford, Illinois


FOR YOUR TOUGHEST MATERIALS HANDLING JOBS . . . SPECIFY THE NEW
PHILCO "THIRTY"
-with 30% Longer Life!
The tougher the jobs, the better this new Philco "Thirty" Storage Battery shows up. For long ramps and heavy loads — Philco "Thirty" delivers the power. And — in addition — it gives 30% longer life! Write today for the new Philco "Thirty" catalog.
The new Philco "Thirty" for electric industrial trucks is identified by its distinctive red connectors.
PHILCO CORPORATION
STORAGE BATTERY DIVISION
TRENTON 7, NEW JERSEY
FOR 50 YEARS A LEADER IN INDUSTRIAL STORAGE BATTERY DEVELOPMENT

Don't "Pass the Shocks"

to the Couplers, Underframe, Car Structure and Ladings



Cardwell Friction Draft Gears

Absorb and Dissipate Shocks at the Couplers

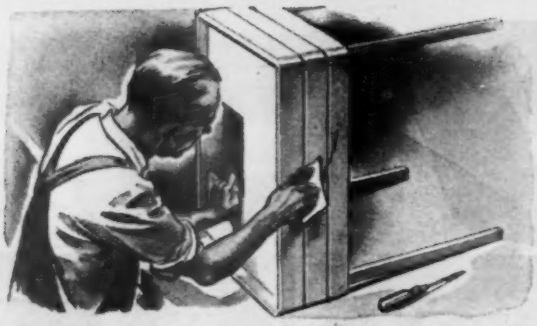
Modern Friction Draft Gears protect the entire car and lading from coupler to coupler . . . from rail to roof.

Over 98% of the cars in freight carrying service are A.A.R. construction, and over 96% have Friction Draft Gears.

Cardwell Westinghouse Co., Chicago
Canadian Cardwell Co., Ltd., Montreal

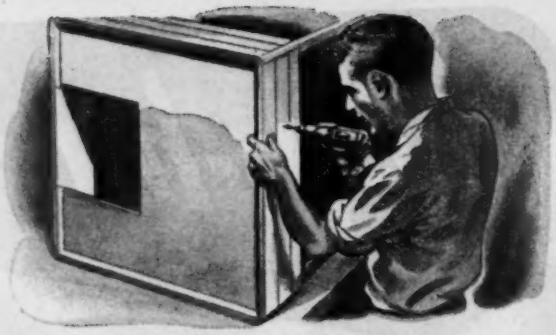
1139

Prepared by VAN AUKEN & RAGLAND *Advertising*



SHUTS OUT SLIP-UPS!

Assembling baby furniture was mighty slow work with slotted screws, one manufacturer found. Too many scratches to refinish – scratches caused by driver skids. So to pick up production he switched to Phillips Screws...



FRIENDLY TO PROFITS!

... out went burred heads and driver skids and slant driven screws. Out went slow-as-molasses hand driving. In came power driving – and with it, savings in time and materials that sliced a big chunk off assembly costs.

LONG ON SAFETY!

By making it stronger and more rigid, and by banishing dangerous burrs, Phillips Screws made this furniture safer for the kids. And your designers will find they do the same things for your product – whether it's tiny as a hearing aid or hefty as a harvester!

TOUGH ON COMPETITION!

Because of the ornamental design of the recess, Phillips Recessed Head Screws impart a "quality look" to any product. They give you a burr-free, blemish-free job that tells prospects you're on *your* toes – and warns competitors to watch out for *theirs!*

It's Phillips ... the engineered recess!

In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

... It's the exact pitch of the angles that eliminates driver skids.

... It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

... It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS Recessed Head SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.

for
DESIGNERS OF
POST-WAR CARS

In addition to air conditioning motor loads and increased lamp loads, modern streamlined cars often have other electrical conveniences which collectively play an important part in passenger comfort and put a premium on the light weight and dependability of the storage battery. Post-war cars, too, are expected to make extensive use of electric power.

IF you want to save weight wherever you can, you will be glad to know that the use of the alkaline battery is one way to do it. Not only is it the lightest weight type of battery available for railway-car service but it saves weight where it counts most—near the middle of the car.

If you want to have air conditioning, ample lighting and other electrical conveniences, you will find the alkaline battery useful for another reason—its unequaled dependability. You can have no better insurance of unfailing power for operating the electrical equipment on the car during non-generating time.

And whether you are planning to use the 32-volt, 64-volt or 110-volt system, you will find that the alkaline battery is time-proved in this respect too. It has been in successful operation for many years with all three systems.

Edison Storage Battery Division of Thomas A. Edison, Incorporated, West Orange, New Jersey.

Edison

THE LIGHTWEIGHT BATTERY
FOR LIGHTWEIGHT CARS

GET TOGETHER DEPARTMENT

FOR SALE

More Service... Less Upkeep

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free
COPR 1937
THE RIDGE TOOL CO.
ELYRIA, O.

when you use the Guaranteed RIGID Heavy-Duty Pipe Wrench

• It looks different—but the real difference is in its performance. The housing simply won't break or warp—no bother or expense of repairs. Full-floating hookjaw (with handy pipe scale) and replaceable heeljaw take hold instantly, won't lock on pipe. Adjusting nut in open housing spins to pipe size. Powerful comfort-grip I-beam handle eases hard pulls. Ask your Supply House for the rugged work-saver RIGID. We're manufacturing more of them than ever, but it's not enough—please be patient.

Strap Wrench, pipe to 5".

RIGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

for the right BRUSH Prescription call in a SPECIALIST

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JULY, 1945

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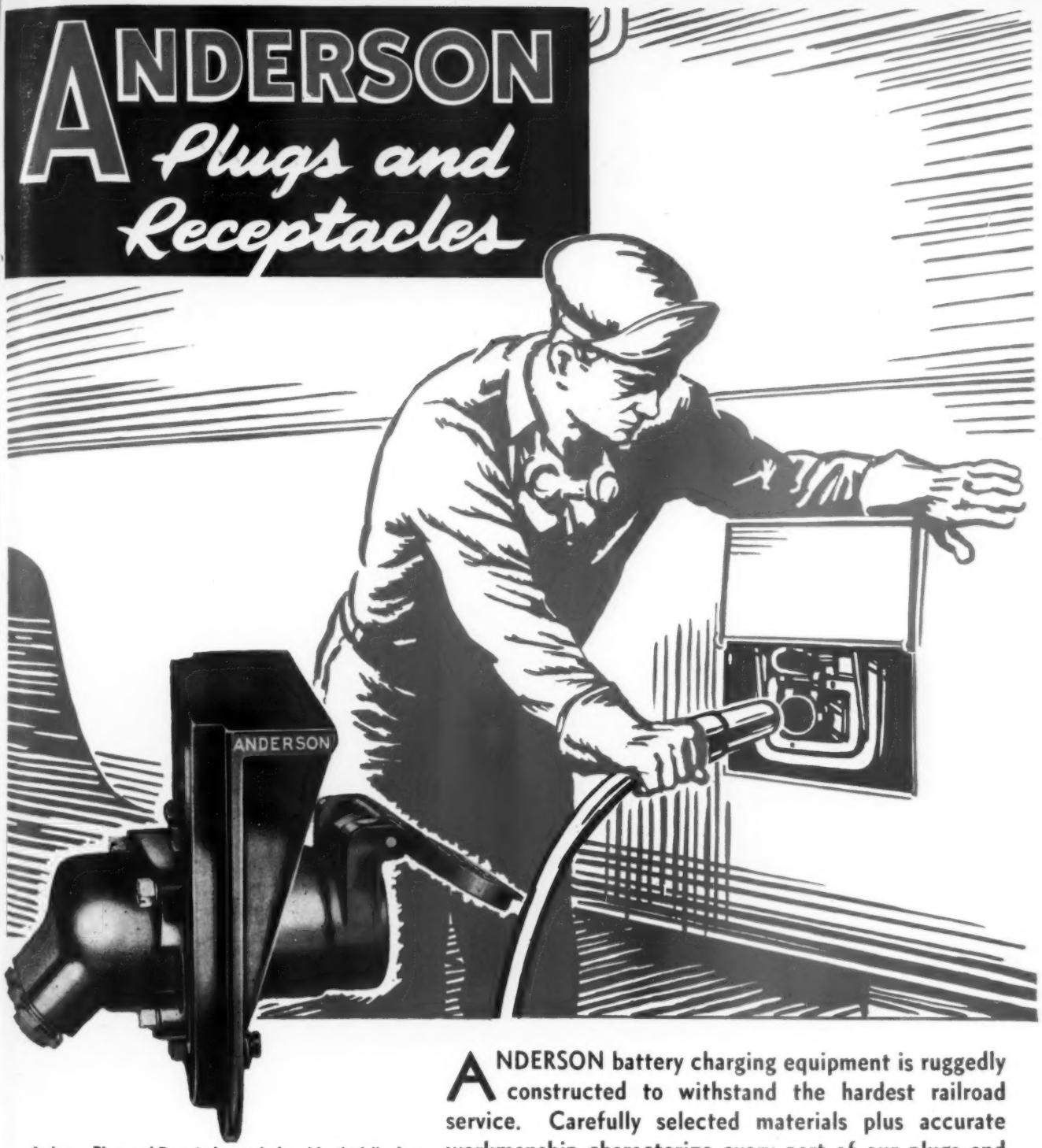

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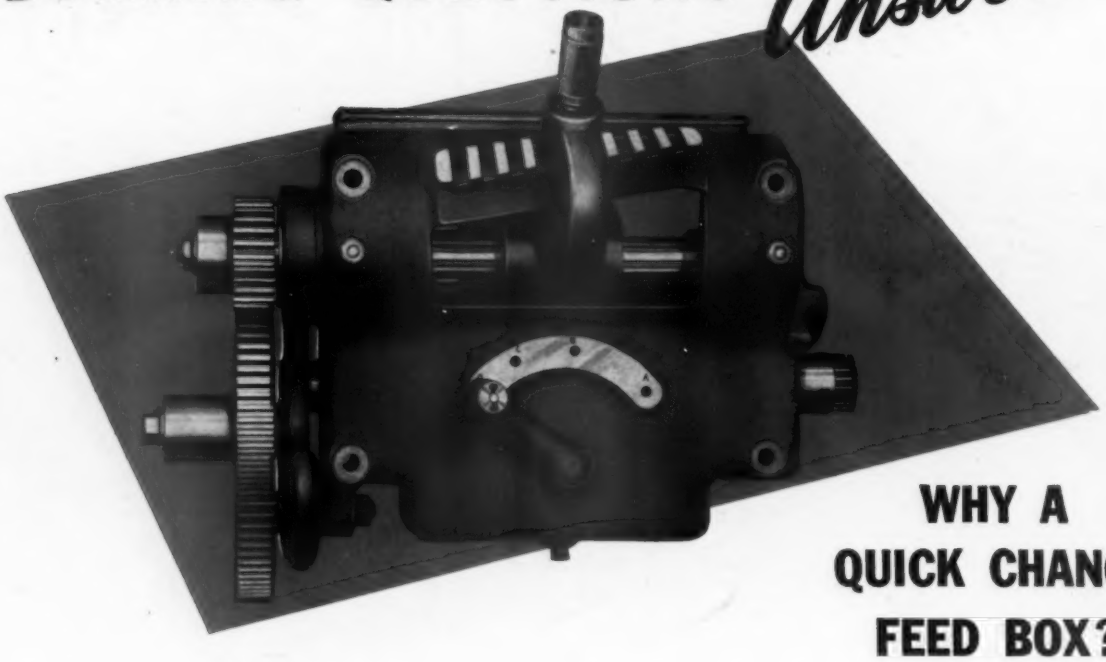

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